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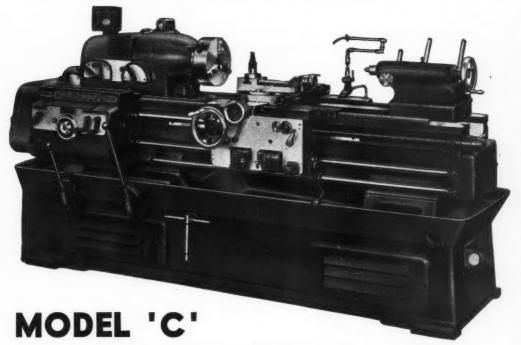


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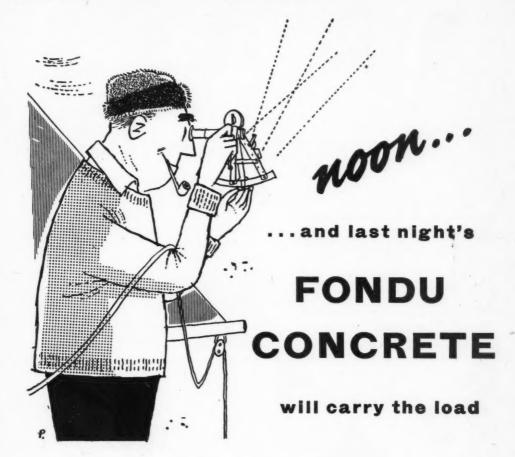
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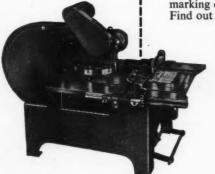


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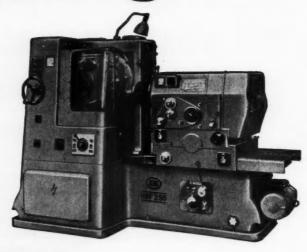


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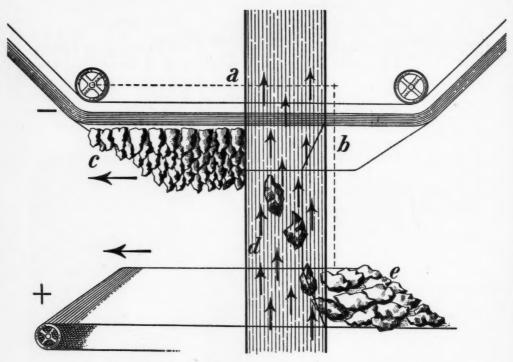
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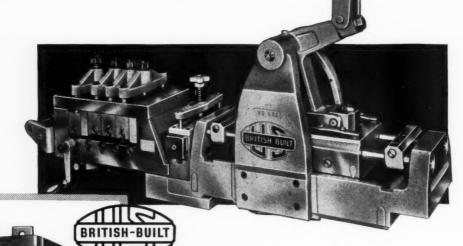
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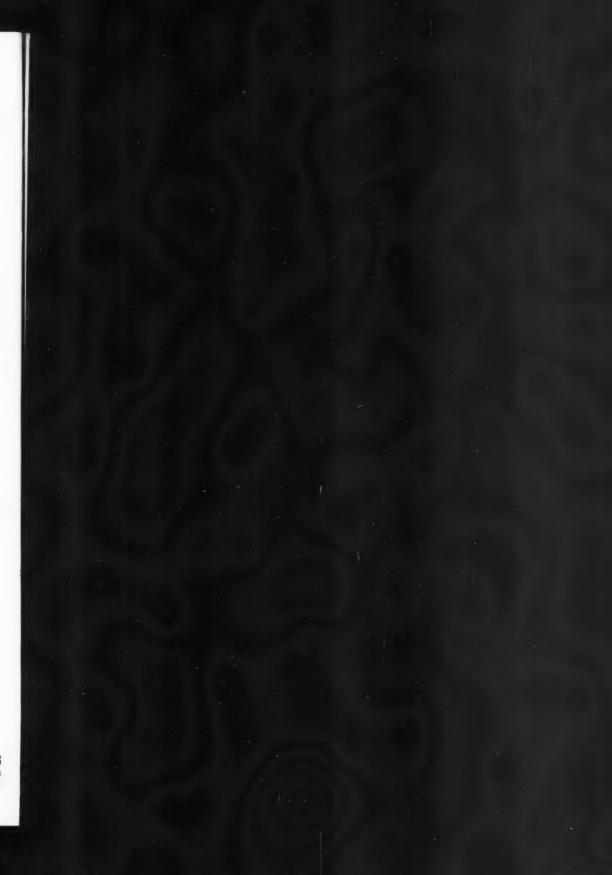
Model No.	Max. Width of Stock	Max. Length of Feed	Max. Stock Thickness
SF-68A	6"	81″	1"
SF-99A	9"	91"	1"

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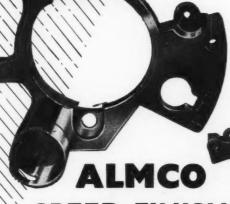
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HORIZONT

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Double guides of knee permit components in excess of 1½ tons to be machined.

heavy duty knee and front operating position.

_	_	Automatic Feeds				
Туре	Table		Long	Cross	Vert.	
KU4 KU5 KU6 KU55 L83	56 % in. 64 % in. 782 in. 64 % in. 157 in.	×××××	152 in. 152 in. 162 in. 26 in. 59 in.	431 in. 511 in. 59 in. 511 in.	27in. 27in. 27in. 37in. 39in.	19§in. 19§in. 19§in. 18∯in. 59in.

Type 'L' Open-side Traversing Head Universal Miller will mill, bore, slot and drill the largest work-pieces at one secting. The unique design permits greatest variety of operation on large work-pieces; the component remains stationary on the large work-chable. Upright slides full length of base table and the sliding ram moves vertically and horizontally.

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MODELS 53 & 61 16 universal head spindle speeds

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MODEL 54. Automatic cross feed of universal head 20in.; 18 universal head spindle speeds 12-1500 r.p.m.; 36 horizontal spindle speeds 6-1500 r.p.m.; 18 automatic feeds $\frac{5}{16}$ -23 $\frac{5}{8}$ in.

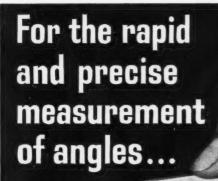


Туре	Table	Long.	Automatic Fe	
53	43½in. × 9½in.	27in.	9%in.	152in.
61	47½in. × 10½in.	30in.	9%in.	152in.
59	51½in. × 11½in.	34in.	11%in.	21 1 in.
54	67in. × 14½in.	43in.	14%in.	2021a.

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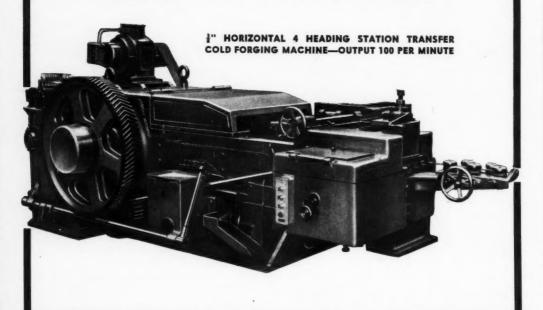
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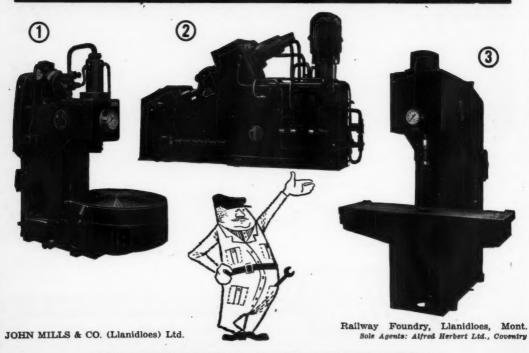
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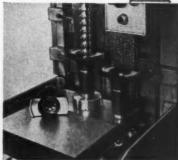
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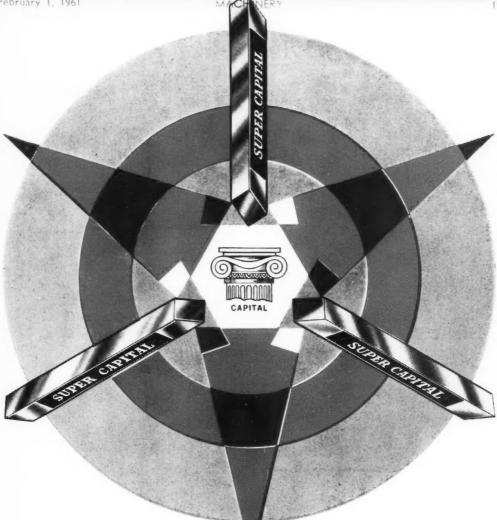
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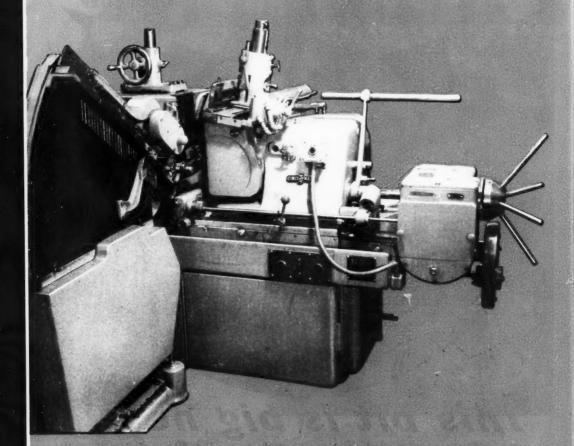
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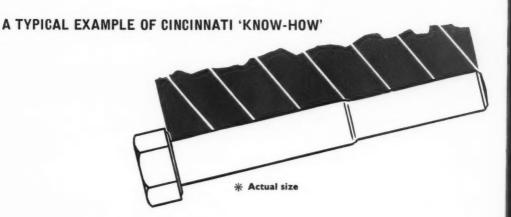
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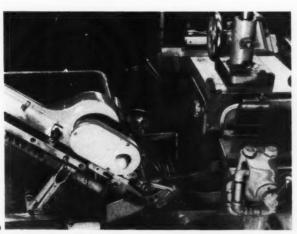
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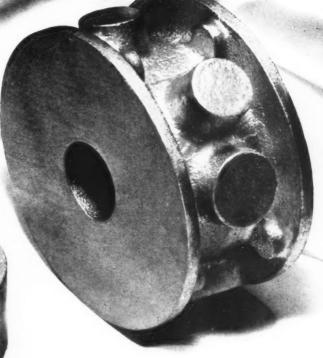
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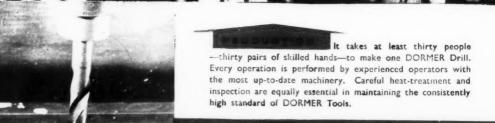
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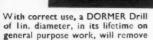
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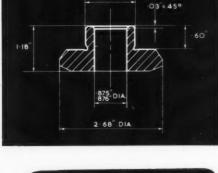




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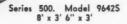
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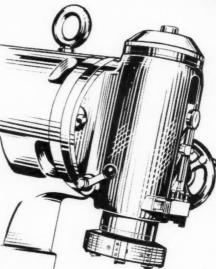
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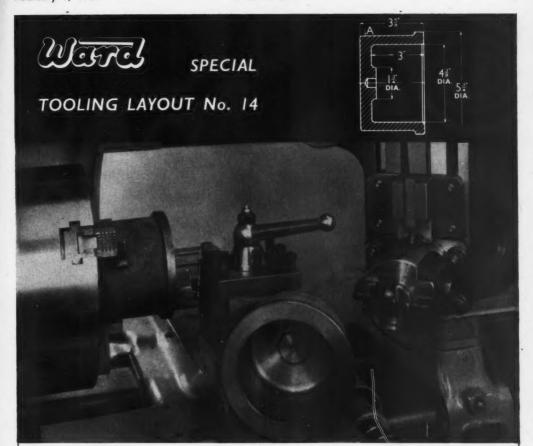
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						Tool Position			Spindle	Max. Cutting Speed		Feed	
	DESCRIPTION OF OPERATION						urret	Cross-Slide	Speed R.P.M.	Feet per min.	Metres per min.	Cuts per inch	m/m per rev.
1.	Grip at A		-	-	-		_	_	_	_	_	_	_
2.	Bore 43" dia., face botte	om.	form	end	boss		-	_	_	_		-	-
	and drill &" dia. hole,		-	-		- 1		-	(177	278	84-8	76	-334
	Turn flange dia., -	-	-	-	-		-	-	1119	180	54-7	Hand	Hand
	Chamfer bore & flange	-	-	-			-		-	-	_	-	-
	Finish face end -			-			_	Rear	177	278	84-8	Hand	Hand
3.	Remove from chuck	-	-	-	-		-	-	_	_	-		-

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	in. 20 in.
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Shaft worms (up to	
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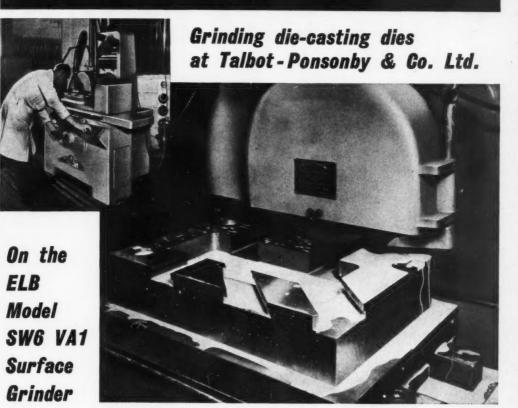




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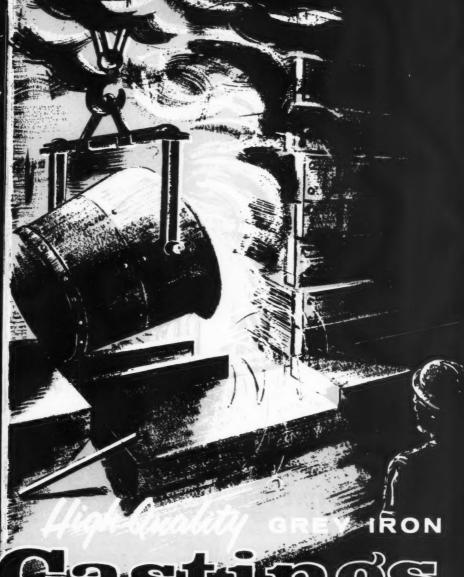
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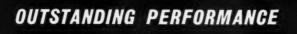
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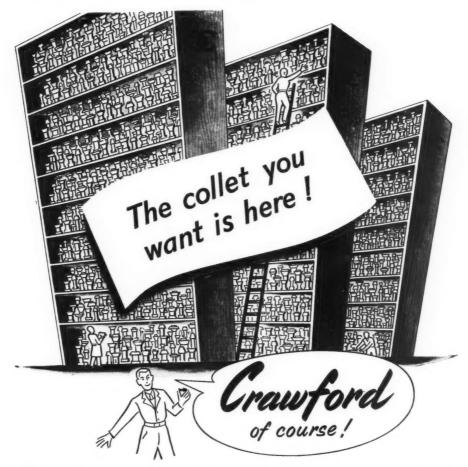
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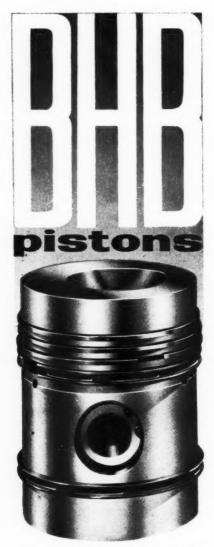
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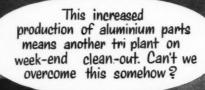
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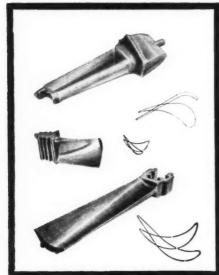
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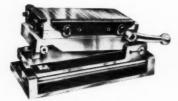
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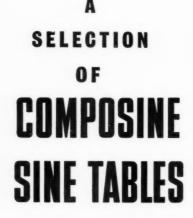
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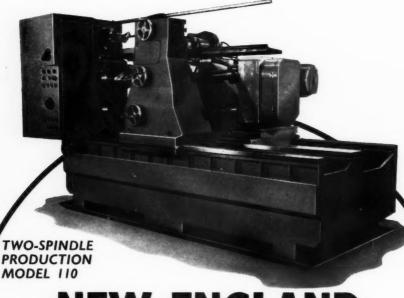


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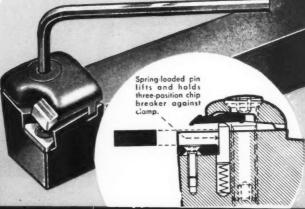
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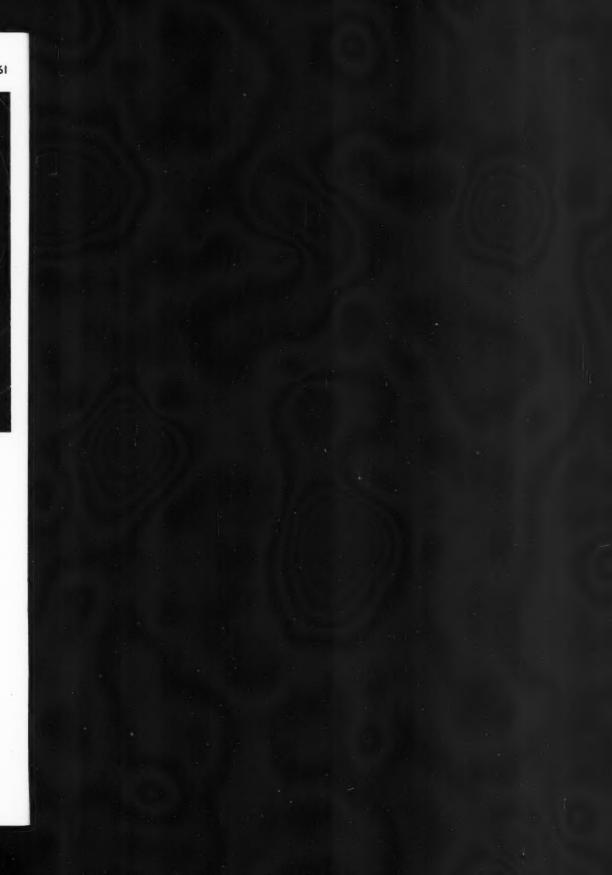


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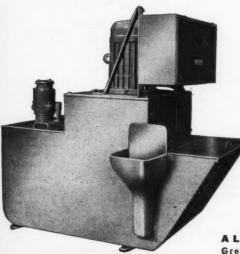
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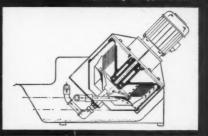


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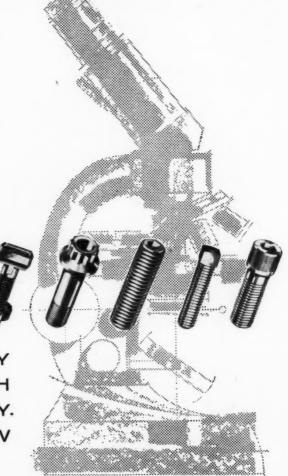




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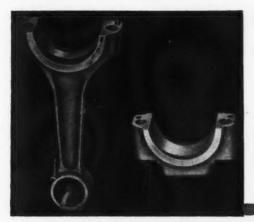
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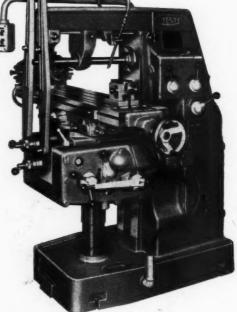




- * Hardened and ground gears
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	cross (without brace)			9in.
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Spindle:	Spindle Nose		No.	40 N.S.
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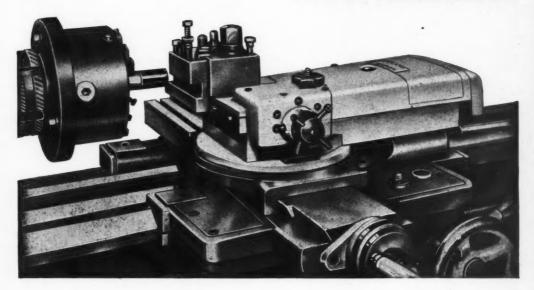
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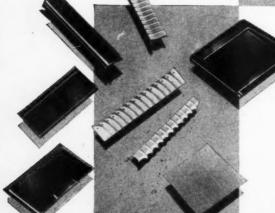
Pines Model 1400 Bender, makesanti-clockwise and clockwise bends. With simplified tools this is an inexpensive machine for experimental and small-lot production work.



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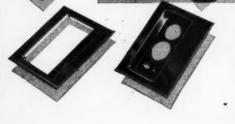


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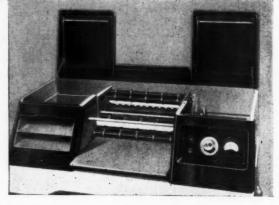
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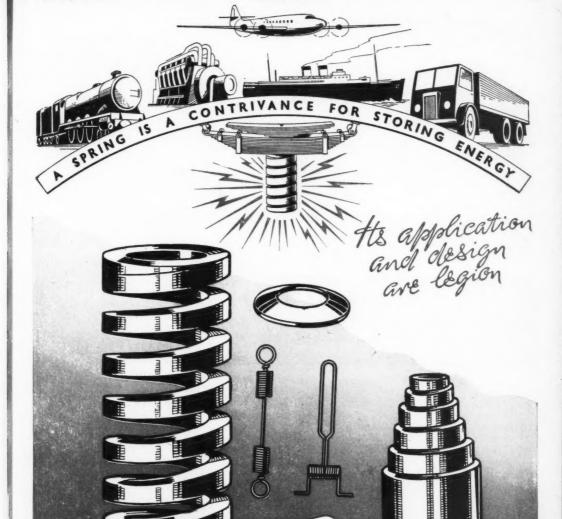
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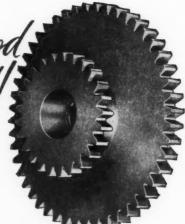
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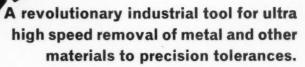
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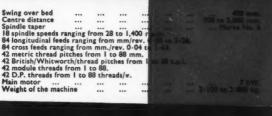
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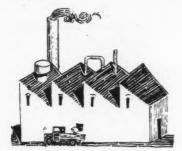
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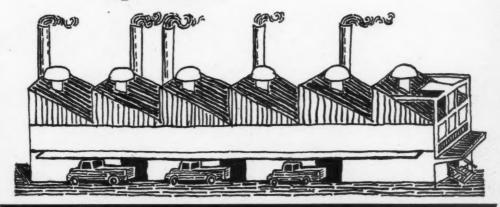


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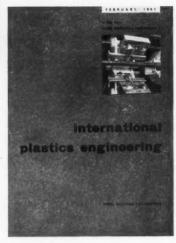
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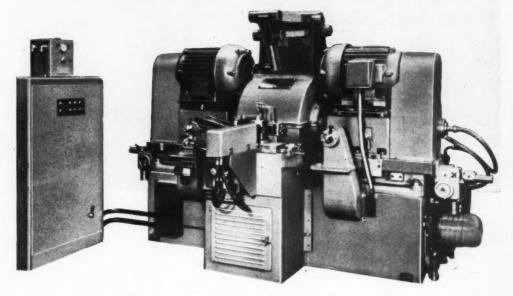
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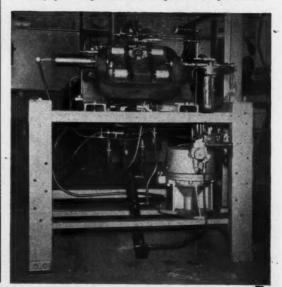
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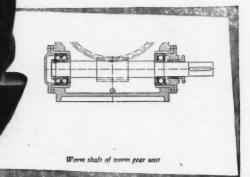
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Abstracts of Principal Articles

The Production of the SIMCA Aronde P. 236

The assembly shop at the SIMCA plant, at Poissy, France, consists of the original main factory building and a new extension which has increased the area by more than 50 per cent. Components from the press shop on one side and the machine shop on the other are fed into the assembly shop, which has sub-assembly sections arranged transversely at one side, whence work is passed to assembly and finishing lines that extend lengthwise. One sub-assembly section provides for the production of doors, and the equipment installed includes two interesting Languepin multi-point spot-welding presses with special arrangements for the transfer of welding tools used for different types of doors. The roof sub-assembly section incorporates a number of floor mounted spot-welding jigs, one of which embodies hydraulic punch units for piercing a number of holes. A large hydraulically-operated fixture provides for piercing other holes, also for trimming the main and secondary pressings of the assembly. Welding of the roof sub-assemblies is completed on a roundabout with four trolley jigs. (MACHINERY, 98—1/2/61.)

New Red Ring Inspection Equipment for Gears P. 248

Recent additions to the Red Ring range of inspection equipment for gears, which is made by the National Broach & Machine Co., Detroit, Mich., U.S.A., includes the rolling gear testers types GRH and GRJ. The latter unit is intended specially for checking gears with integral shafts, and can be fitted with new recording equipment of the paper strip type. Other machines described in this article include the type PCB involute tester for gear shaving cutters and the type GSC gear speeder which is equipped with a microphone, an amplifier and a dial-type meter. (MACHINERY, 98—1/2/61.)

Quantity Production of Laminations for Transformer Cores P. 250

A special fully-automatic installation for producing laminations for transformer cores in a wide variety of sizes and designs has recently been put into operation at the Transformer Department of Ferranti, Ltd., Hollinwood, Lancs. The new equipment is akin to a transfer press and has an overall length of 60 ft. Special cold-rolled grain-orientated steel, in coil form, is fed to the installation, which incorporates two main press sections. Two completely pierced and

blanked laminations are produced at each stroke of the presses, and are delivered to special stacking units at opposite sides of the machine. Since at both press stations the strip is located from its theoretical centre line, any manufacturing errors are halved and it is stated that a considerable increase in the accuracy of the laminations has been obtained as a result. (MACHINERY, 98—1/2/61.)

Transistor Production in Japan ... P. 253

The Tokyo Shibaura Electric Co., Ltd., which is one of the largest firms engaged in electrical manufacturing in Japan, recently built a special factory designed specifically for the mass production of a range of transistors by the most modern methods. The building is mainly of windowless construction, and all the production areas are supplied with filtered air at a constant temperature and controlled humidity. Some 2,800 people are employed, on a two-shift basis, and some 5,000,000 transistors are produced per month. Brief reference is made to some of the special machines developed for operations on transistor components. (MACHINERY, 98—1/2/61.)

Cross Transfer Machine for Small Cylinder Blocks P. 272

This article describes a complex in-line transfer machine which has been supplied by the Cross Company, Detroit, Michigan, U.S.A., for operations on small cylinder blocks. The machine provides for milling a number of faces, also for drilling and boring a total of 123 holes of different sizes. Operations include cylinder boring, cam- and crank-shaft boring, assembly of main bearing caps, water pressure testing to detect porosity, and final inspection with the aid of air gauging equipment. (MACHINERY, 98—1/2/61.)

At the Ford Tractor and Implements Division Works, Mich., U.S.A, a Schraner machine is employed for rolling the fillet radii of the main and pin journals of diesel-engine crankshafts. Wedge-shaped freerunning rollers are applied under pressure to the fillets, and provide for "kneading" the metal. The rolling operation is stated to increase the hardness value of the fillet from 34 to 55 Rockwell C, and to provide a surface finish of 30 to 12 micro-in. (MACHINERY, 98—1/2/61.)

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If you know of a more efficient way of designing a tool, gauge, fixture, or mechanism, machining or forming a metal component, heat treating, plating or enamelling, handling parts or material, building up an assembly, utilizing supplies, or laying out or organizing a department or a factory, send it to the Editor. Short comments upon published articles and letters on subjects concerning the metal-working industries are particularly welcome. Payment will be made for exclusive contributions.

UNIONE DITORIAL

Health in Industry

Apart from the humanitarian aspects, the physical and psychological well-being of those employed in industry continues to assume increasing importance in connection with productive efficiency. With advances in mechanization and automation, there is inevitably a trend towards greater inter-dependence between the activities of groups of workers, and unexpected absences on account of injury or sickness may cause much greater dislocation than would result if the tasks of those concerned were not directly related to the activities of their neighbours in the factory. Similarly, if one worker in a team, or on a production or assembly line, although present, is unable to maintain the customary pace and quality by reason of temporary physical unfitness or mental disturbance, the effects may be far-reaching. Obviously, if manufacturing or assembly operations are highly integrated, there must be an efficient organization within a works to ensure that at any time the labour force immediately available can be rapidly and smoothly deployed in such a way as to minimize dislocation caused by absentees. In general, however, if the best results are to be obtained from any given installation of production equipment, it is desirable that all reasonable steps should be taken to reduce, as far as possible, loss of time occasioned by ill-health or accident.

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As has often been shown, it may prove economical, as well as otherwise desirable, to provide a working environment of a higher standard than is strictly necessary to satisfy the statutory requirements. It may be found, for example, that the cost of ensuring greater cleanliness, or of providing better lighting, heating or ventilation, may be more than recovered as a result of improvements in work output or quality. In the same way, the introduction of safeguards more elaborate than those demanded by law, apart from affording added protection against injury, may result in a higher speed of working occasioned by greater confidence.

Apart from what can be accomplished in these directions, however, important contributions are made by the factory medical services, and the work that is being done was very competently discussed by Prof. Ronald E. Lane, C.B.E., M.D., M.Sc., in the Sir Alfred Herbert Paper presented last year to the Institution of Production Engineers. Industrial medicine, he explained, covers a very wide field, "it is concerned with the accident to the

apprentice and with the production manager's nervous breakdown, with the effects of a new chemical and the design of a typist's chair." The preventive aspect of this work is of particular significance, and is becoming increasingly complicated. At the same time "the treatment side in industry is considerable and is larger than is sometimes realized."

To supplement the activities of the Medical Inspectors of Factories and the Appointed Factory Doctors, voluntary services have been introduced and have grown comparatively rapidly during the past 30 years. The object of these services, which have not been confined to dangerous trades, is to provide the employer with better means for carrying out his statutory duties, and with more effective medical facilities that go beyond statutory requirements. Accepted functions of such a service fall into two main groups, namely, those directed to the individual worker, to ensure that he is fit for his job, and those directed to the environment to ensure that it is fit for the worker. For obvious reasons, the more complete voluntary services tend to be confined to the larger industrial organizations, and it is estimated that not more than half of the total number of factory workers have the benefit of such services. The possibility of extending these services to many smaller factories might well be examined, but it is probable that in numerous instances they would be difficult to provide and, indeed, difficult to justify. Prof. Lane concludes, however, that every encouragement should be given to the expansion of voluntary services.

To remain effective, provisions for the health of factory workers must obviously be kept up to date, and to this end changes in industry must be kept under close scrutiny. Among the problems associated with the "prescription of a healthy physical environment" which are now awaiting solution may be mentioned the long-term effects of certain chemicals, the best use of the middle-aged and older worker, the changes resulting from automation, and the physiological effects of shift work.

In conclusion, attention may be drawn to Prof. Lane's statement that "industry has far greater powers to influence health than any doctor" since health depends so largely on a reasonable standard of living and on equanimity. The standard of living, in turn, is dependent on the prosperity of industry. Moreover, "industry's influence on peace of mind can be enormous."

The Production of the SIMCA Aronde

Methods and Equipment Employed for the Production of Body Components for this Popular French Car in the New Works at Poissy

By P. A. SIDDERS, Chief Associate Editor

EARLIER ARTICLES IN THIS SERIES* have been concerned with the machining of various components for the Aronde car, which is now being produced in large quantities by the French firm of SIMCA, also with heat treatment facilities, and equipment in the press shop at the Poissy plant. This article, and others to be published in forth-coming issues of MACHINERY, will be devoted to the production of body sub-assemblies, body build-

ing and welding, painting, trimming and finishing.

Fig. 1 is a diagrammatic layout of the Poissy factory, with the flow of work indicated. The main assembly shop A is located between the machine shop B and the press shop C, and comprises the main building of the old Ford plant, which covers an area of 63,500 sq. yd., and a new extension of 38,200 sq. yd. This extension is partly of two and partly of three storeys, and the upper floors house the paint shop and associated departments. Raw material flows into the plant by the route indicated at D, and components pass

* Machinery, 95/252-19/8/59; 95/676-7/10/59; 96/784-6/4/60; 96/860-20/4/60; 96/1036-11/5/60; 97/80-13/7/60; 97/1104-16/11/60; 97/1220-30/11/60; 97/1392-21/12/60; and 98/18-4/1/61.

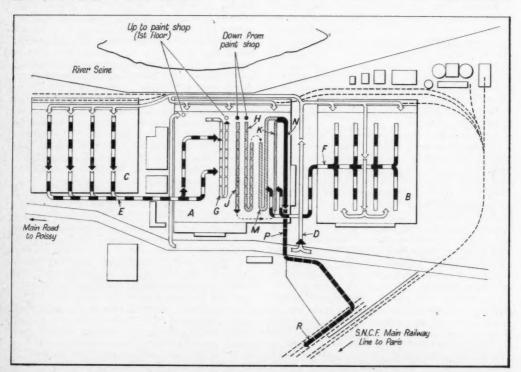


Fig. 1. Diagrammatic layout of the SIMCA plant at Poissy, France, showing the flow of work into and through the main assembly shop A. The machine shop is seen at B and the press shop at C.

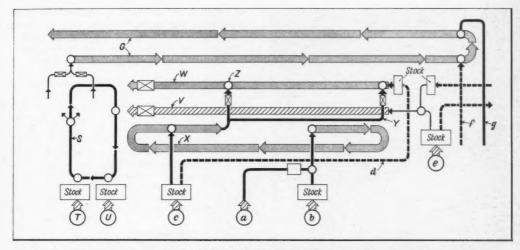


Fig. 2. Schematic layout of the main body building line G, the under-body finishing line W, the roof finishing line V, and auxiliary sections in the assembly shop of the SIMCA plant

from the press shop to the sub-assembly and spotwelding sections of the assembly shop by way of the route indicated at E. Those parts that flow direct from the main machine shop to the assembly shop follow the route F.

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In the sub-assembly sections of the main assembly shop, the work flows across the shop towards the main body assembly line G, which is of elongated-U form, and on reaching the end of this line, the body shells are transferred by conveyor to the paint shop on the floor above. The layout of this department, and the operations performed therein, will form the subject of a later article.

From the paint shop, the body shells are returned to the ground floor and pass to the starting end of the trimming line H, which is also of elongated-U form, but with legs of uneven length. The line J, it may be mentioned, provides for trimming operations on the larger Vedette car, which is built in smaller numbers, and from the end of this line, Vedette bodies pass to the final assembly line K. Bodies for Aronde cars are transferred from the end of the trimming line to a final assembly line M, also of elongated-U form, and completed cars from the end of this line, also cars from the Vedette line, pass to the finishing and touching-up line N. The end of this line connects with a subway P, through which the cars are driven to an outside parking area, adjoining the loading bay R for rail transport.

The layout of the sub-assembly sections and the

body-building line is shown in more detail in Fig. In this illustration, the main body assembly line is again indicated at G, and its starting end is adjacent to a closed-loop trolley line S, known as "berceau", which provides for the assembly and spot welding of the roof to the under-body, and the attachment of various other sub-assemblies. These latter units include the front wings and cross-member sub-assembly, which is fed to the berceau as indicated by the arrow T, also the front body sub-assembly, comprising the front bulkhead and the inner wings, which is delivered as shown by the arrow U. Roof sub-assemblies are delivered to the berceau from the end of the finishing conveyor V, and under-bodies from the end of the finishing conveyor W.

Under-bodies are built up on a closed-loop spotwelding line X, and it may be noted that different designs are employed for the 2-door and 4-door cars. Under-bodies for 2-door cars are transferred by the conveyor Y to the starting end of the finishing line, and those for 4-door cars are delivered to an intermediate point Z. Front and rear floor panel sub-assemblies are fed by conveyor to the spot-welding line X from a section at one side as indicated at a, and side members are delivered to the same point from a section indicated at b. Subassemblies comprising the rear wings and luggage boot rear bulkheads are prepared in adjoining sections, and are fed towards the spot-welding line as indicated by the arrow c. Sub-assemblies for 2-door cars are transferred by truck to the start-

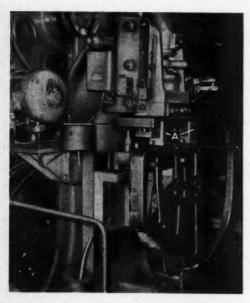


Fig. 3. The set-up for piercing the hinge fixing holes in Aronde doors on a Spiertz plain-fronted power press

ing end of the finishing line, as shown by the dotted line d, whereas those for four door cars are delivered by conveyor to an intermediate point on the line X.

Roof sub-assemblies are delivered from a section at one end of the depart-

at one end of the department as indicated by the arrow e, and are transferred by conveyor to the head of the roof finishing line. Bonnets

Fig. 4. One of the two Languepin multipoint spot-welding machines for the assembly of door inner and outer panels. Each machine is used for doors of two different types, and the tool for one type is stored on an extension at one side while the other tool is in use

and boot lids are delivered by truck as shown by the dotted line f to the body assembly line, and doors are transferred by the conveyor g.

DOOR PRODUCTION

Front and rear doors are built up in a narrow section at right-angles to the roof and under-body finishing lines. Pressings are delivered to the end of the section remote from the finishing lines by fork-lift truck and are stored on stillages. Early stages in the production sequence provide for deburring and scurfing the outer panels at benches, with the aid of portable electric tools, followed by the application of bituminous sound-deadening material. This material is laid in the required positions on the panels which are then fed through a conveyorized infra-red oven. The material softens and adheres to the panels during their passage through the oven.

passage through the oven.

After deburring and preliminary spot-welding operations to secure certain reinforcing members, door inner panels are passed to a Spiertz plainfronted press on which the hinge fixing holes are pierced. This press is shown in Fig. 3 with an inner panel for a rear off-side door in position. Since panels may be of four types (front or rear, near-side or off-side), a corresponding number of press tools is required. Spare tools are stored on a roller conveyor fitted to a supporting framework at one side of the press, and are transferred to the narrow table, bolted to the front of the press frame, by means a short length of roller conveyor mounted on a trolley. Each press tool is provided with ball-bearing guide pillars and bushes, and incorporates



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Fig. 5. Close-up view of one of the tool assemblies for doors used on the Languepin machine. Before the tool is moved to the storage position, the lower element is secured to the top member

a spring-loaded stripper plate, the springs taking the form of stacks of Belleville washers. The door inner panel is thrust inwards, into contact with a stop bar on the lower tool, by spring-loaded steel blocks carried on two brackets, as at A, secured to the upper tool assembly.

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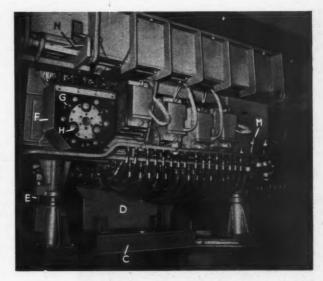
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Door inner panels unloaded from the Spiertz press, are passed alternately to benches at each side. Adjacent to each bench there is a riveting machine, the operator of

which assembles the hinges and secures them in position. From these machines, the inner panels are loaded on to a chain conveyor, which also receives the outer panels from the outlet end of the infra-red oven. On this conveyor, the panels are carried to two multi-point spot-welding machines supplied by La Soudure Electrique Languepin. One spot welding machine provides for the assembly and welding of front offside and rear near-side doors, and the other for front near-side and rear off-side doors. It will be understood that different tools are required for the various types of doors, and the tools for the front doors provide for making 62 spot-welds, and those for rear doors, 58 spot-welds. The machines are used alternately, and while one machine is in operation, the tooling on the other is changed and service work is carried out.

TOOL TRANSFER ON SPOT-WELDING MACHINE

A general view of one of the Languepin spotwelding machines is given in Fig. 4, and each is completely self-contained, with built-in supply systems for hydraulic and pneumatic power. The machine proper is approximately square in plan, and occupies the area immediately in front of the operator in the figure. On either side of the main structure, there are extension wings, the ends of which are supported on circular columns. Below these wings are mounted rails which pass through the main structure of the machine, and the two spot-welding tools used with each machine are



arranged to travel along these rails. The arrangement is such that while one tool is in use, the other can be stored clear of the work-zone, suspended from the rails below one extension wing. When a tool change-over is necessary, the tool that has been used in the machine is moved sideways to a position below the other extension wing, as indicated at B, after the electrical and other supply lines have been disconnected, and the other tool is traversed into the working position. The tools are moved from the machine to the storage positions by means of a pneumatic cylinder and cable.

Fig. 5 is a close-up view of the tool at B, Fig. 4, and it will be observed that it is a self-contained unit. The lower tool assembly C moves on four guide pillars that project downwards from the upper assembly, and incorporates a formed support block D for the door outer panel. On each guide-bush bracket of the lower tool there is a swinging bolt, as at E, and before the tool is traversed to the storage position, each bolt is swung upwards between the cheeks of a yoke piece on the guide pillar bracket at one corner of the upper tool. A nut is then tightened on each bolt to secure the lower tool to the upper assembly, so that the tool moves as a unit.

At one end of the upper tool there is a large electrical connection box F, which provides for the supply of power to the various banks of electrodes. This box incorporates three plain bushes, as at G, a central bush which has an internal square-section thread, and a series of sockets, as at H. When the tool has been moved to the



Fig. 6. The loading arrangements on the Languepin multi-point spot-welding machine for doors. An air operated loader carries the work from the rollers in the foreground to a position over the support block of the lower tool

working position, a corresponding box connected to the machine is assembled to the box F, and a series of plug pins engage the sockets. This box may be seen at J in Fig. 6, and it has three coneend pins to engage the bushes G, Fig. 5, and thus ensure that the electrical connections are made correctly. A large insulated handwheel K, Fig. 6, is keyed to a central screw, which mates with the central threaded bush to secure the box J in position, and a handle is provided at each side of the box to facilitate manipulation.

Hydraulic connections are made by couplings, as at L, attached to the ends of short lengths of flexible pressure-tubing. There are four lengths of tubing, fitted to the ends of pipes at the front of the machine, which are connected to the hydraulic supply unit on the superstructure. The sockets for these couplings may be seen at M in Fig. 5. Cooling water connections are made by means of quick-release couplings to pipes mounted on the right-hand front upright of the machine. With the arrangements described, the time required for tool changing is 45 min.

It may be mentioned here that the upper tool is not carried on the supporting rails by the whole length of its front and rear sides, but only by a

portion at each end. When the tool is in the storage position, these bearing portions rest on sections of rail fitted to hinged brackets as at N, Fig. 5. Normally, these brackets are secured in the position shown by screws, and the short sections of rail mounted thereon are aligned with the main rails. Above each extension wing there is a gantry from which an electric hoist is suspended, as may be seen in Fig. 4. When it is necessary to remove a spot-welding tool completely from the machine, the hook of the hoist is coupled to the tool, and the slack in the hoist chain is taken up to support the weight. brackets carrying the short sections of rail are then released and swung downwards and outwards, and each is secured in a position clear of the tool by a pin which passes through a hole in an integral extension arm. By means of the hoist, the tool can then be lowered clear of the extension wing

As may be seen from Fig. 5, all the spot-welding electrode assemblies are disposed horizontally, and each incorporates a hydraulic cylinder to urge the moving electrode towards and away from the work. Assembled door inner and outer panels are loaded on to the banks of rollers, seen in the foreground in Fig. 6, which are supported on pillars at the front of the machine. Between the banks of rollers move dogs and supports attached to a loading shuttle, which is carried on rails at either side, as at P. The shuttle is moved on these rails by a lever R, actuated by an air cylinder S, controlled by solenoid operated valves. arrangement is such that the door assembly is carried by the shuttle into the machine and positioned over the support block (D, Fig. 5) of the lower tool, which is then raised to lift the work to the electrodes of the upper tool. After welding has been completed, the door assembly is automatically discharged on to rollers, at the rear, which are similar to those at the front of the machine. At the time of the visit during which the information for this series of articles was obtained, the door assemblies were transferred manually from the rear of the machine to a chain conveyor. It was planned, however, to install an automatic lifting arrangement to pick up the assemblies from the rollers and hook them on the conveyor hangers.

From the Languepin multi-point spot welding machine, each door assembly is transferred to a single-point spot welder whereby six welds are made to complete the welding around the window opening. Rear doors are then loaded on to the hangers of a storage conveyor, which circulates above the section. This conveyor is more than 5,000 ft. long and has capacity for storing 3,000

Front doors are delivered to either of two special forming presses built by SIMCA, whereby the flange at each side is bent inwards. Inner and outer door panels are produced with the flanges at either side bent initially to an included angle of 110 deg. to the panel faces. When the panels are assembled, the flanges nest one inside the other, a double thickness of metal being thus provided at the edges. After the bending operation on the SIMCA presses, the flange edges are set, at an included angle of 70 deg. to the panel faces.

Fig. 7 shows one of the SIMCA presses, and each has a main structure, fabricated by welding from steel plate, with a face at the front inclined at an angle of approximately 15 deg. On this face, at the left-hand side, is mounted a forming unit T, which is fixed in position. This unit has a main body, of inverted-L section, that houses a sliding blade. At the right-hand side of the press there is a similar unit U, which is arranged to pivot, and can be swung outwards to the position shown, to facilitate loading. This unit incorporates a second sliding blade, as seen at V, and the blades of both units are moved towards and away from the press frame by hydraulic power. The swinging motion of the right-hand unit is effected by a hydraulic The blades cylinder within the main structure. are shaped to suit the profile of the door at each

side, and each is of stepped form, with an angular shoulder between the

two step faces.

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With the unit U swung outwards, and both blades moved away from the main structure of the press, a door assembly is loaded so that its outer panel rests on supports at either side of the inclined face (as indicated at W) and its bottom edge contacts the brackets Y. A micro-switch is mounted on this inclined face and unless a door assembly is in position, this switch remains open, and the press cannot be operated. After loading an assembly, a pedal switch is tripped, and the unit U then swings inwards to the working position. second micro-switch is then closed, and the two blades are moved inwards, in succession. During the movement of each blade, the angular shoulder face bends the flange of the associated edge of the door to an included angle of 70 deg.

After the edge-bending operation, front doors are loaded on to the storage conveyor. It may be mentioned here that the workers in the sections

of the department so far described produce doors of one type only each day. The section operates on two shifts and 1,400 doors are made per day. Doors of all four types are stored on the overhead conveyor, which feeds the next section.

This section comprises four parallel scurfing and finishing lines, some of which are seen in Fig. 8. For each line there is a floor-mounted slat conveyor, and on every sixth slat is fitted a work-support fixture, embodying a universal ball joint. The tiltable member of the ball joint carries a platen with projections and flanges to locate and steady the door assembly, and the latter is retained in position by means of a toggle-type clamp, as indicated at X. This clamp is bolted to a bracket fitted to the under-side of the platen, and the clamping arm swings through an opening in the platen to engage the workpiece. The arrangement is such that the door assemblies can be readily tilted into the most convenient positions for the scurfing operations that are to be performed, and these operations are carried out with the aid of portable electric power tools. Supports, made from bent and welded steel rod, are fitted to intermediate slats of the conveyor, to hold the tools when the work is being re-

From the ends of the conveyorized lines, the door assemblies are transferred to a chain conveyor,

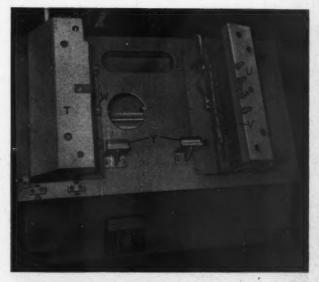
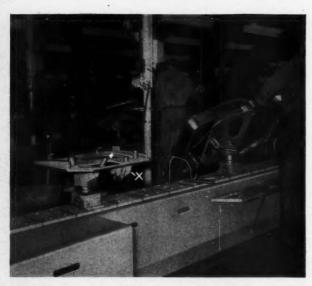


Fig. 7. This special purpose press has been built by SIMCA and provides for bending the flanges at the sides of each door to an included angle of 70 deg. The right-hand bending unit swings outwards to facilitate loading



whereon they are delivered to the body-building line, as already described.

ROOF PRODUCTION

A roof assembly for an Aronde car incorporates two principal components, one of which—the larger—comprises the roof proper, also the side members and the lower cross member of the wind-



Fig. 8. Part of the four parallel finishing lines for doors for the Aronde car.

Work-support fixtures with universal joints are mounted on the slat conveyors

screen surround, all formed as one integral pressing. At the end remote from the windscreen, this pressing provides the upper edge of the rear window surround, but the side members and lower cross member of this surround are formed by the smaller main component. The larger pressing incorporates a strut between the upper and lower edges of the windscreen opening, which serves to strengthen it before the various reinforcing members are welded in position, thereby reducing distortion, and this strut is removed at an inter-

mediate stage in the operation sequence. These larger pressings are brought to the sub-assembly section at the starting end of the roof finishing line (V, Fig. 2) supported on special trolleys. Each trolley has two horizontal arms that pass through the windscreen openings of a stack of pressings, which hang downwards.

The pressings are delivered to an area adjacent to the welding jig shown in Fig. 9, and in this

illustration the strengthening strut in the windscreen opening can be clearly seen. This jig is employed for welding a reinforcing member to the upper portion of the rear window surround, and it is therefore inclined so that the operator can adopt a comfortable stance. Supports are provided for the work along the two side edges, as at A; at the upper corners of the windscreen surround; for the side members of the windscreen; and for the rear end of the pressing. Air operated

Fig. 9. The welding jig in the roof sub-assembly section which is used for holding the main roof pressing while a reinforcing channel is welded to the upper edge of the rear window surround

This floor-Fig. 10. mounted, hydraulicallyoperated fixture provides for piercing holes in the front cross member of the main roof pressing, also for trimming the joint areas of this pressing and of a smaller pressing that completes the rear window opening

clamping arrangements, as at B, are incorporated for the rear end of the pressing, and the front end is held against the by locations toggle clamps, as at C.

A reinforcing member

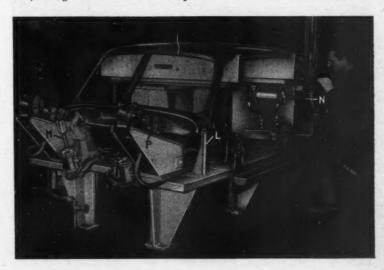
is placed in position before the air clamps are applied, and these units are controlled by a foot-actuated valve. The operator then welds the reinforcing member to the main roof pressing, using a hand-held spot welding unit, the weight of which is supported by cables from two self-coiling reels, attached to an overhead framework. Current for the welding unit is supplied from a transformer mounted within the jig structure.

From the welding jig, the roof pressings are transferred to a floor-mounted piercing and trim-

ming fixture. Shown in Fig. 10, this fixture is completely self tained, and incorporates a number of hydraulically - operated punch die assemblies, and which are supplied with pressure-fluid from the pump and reservoir unit D. There are two punch and die assemblies as at E, which pierce holes in the front cross-member of the pressing to provide for the passage of the windscreen wiper shafts. Each of two assemblies at the front of the fixture, behind the pump and reservoir unit, provides for piercing four holes in the front of the crossmember, for the attachment studs of a windscreen wiper motor. One of these assemblies is just visible at F.

Reference has already been made to the smaller main component of the roof sub-assembly, and

Fig. 11. The jig for holding the main and secondary pressings of the roof sub-assembly while the joints at either side are oxy-acetylene welded. Hydraulic units at the front serve for piercing two groups of holes



one such component is seen at G. To ensure accurate matching of the joints between the roof sub-assembly and under-body, both the main pressings are loaded into the fixture, and their joint faces are trimmed by hydraulic cropping units. There are two of these units at each side of the fixture, and the unit for trimming the left-hand front joint face (as viewed in Fig. 10) is indicated at H. Scrap material from the trimming operation falls into a chute I, and is directed into a container within the fixture frame.

All the hydraulic units of the fixture are controlled from two stations K, which are so located that the operators must be clear of the fixture and must use both hands. It may also be observed that the stations are fitted with shrouds to prevent

accidental operation.

WELDING AND PIERCING JIG

After the piercing and trimming operations, the two roof pressings are passed to either of two identical welding jigs, one of which is shown in Fig. 11. The locations at the rear end provide for positioning the smaller pressing correctly in relation to the main roof panel, the previous trimming operation ensuring that the joint edges are correctly matched. At the front of the jig, there are supports, as at L, which are engaged by the trimmed joint edge at either side of the front cross-member of the main panel, and the roof

portion of the pressing is supported on two transverse beams. The two components are secured in position by air-operated clamps, as at M and N, which are of the simple direct-acting lever type. With the pressings supported and clamped, the joints between the two components at the rear are oxy-acetylene welded by hand.

The jig also provides for piercing two groups of holes at the front of the cross-member of the larger pressing, one group serving for the attachment of the engine serial number plate, and the other for the body number plate. These holes are pierced by hydraulically-operated punch and die assemblies, one of which is indicated at P. Each assembly is carried on an inclined, weld-fabricated bracket, and the operating cylinder is mounted between the bracket side walls. The piston rod of the cylinder is coupled by two linkages to the cylindrical ram that carries the punches, and a spring-loaded stripper plate is fitted.

From the welding and piercing jig, the roof sub-assemblies are transferred to either of two stations where the welded joint at the rear is dressed. These stations are equipped with jigs of tubular construction, and dressing is carried out

with air-operated portable tools.

Roof sub-assemblies are next passed to a further spot-welding station for the attachment of reinforcing inner frames to the windscreen and rear window surrounds. Fig. 12 shows the jig at this station, and it will be observed that there are

three operators, two of whom carry out the spotwelding operations at the rear of the assembly (to the right in Fig. 12). The remaining operator is responsible for spotwelding the front reinforcement. Air - actuated clamps are provided internally and externally at the front end of the jig, but the clamps at the rear end are of the hand-operated toggle-lever type.

Loading of the reinforcing frames and the previously-welded sub-assembly is undertaken by two of the operators, and during this stage, the third operator pierces a number of holes for the subsequent attachment of lining



Fig. 12. The jig employed for holding the roof sub-assembly while reinforcing frames are assembled and welded to the windscreen and rear window surrounds

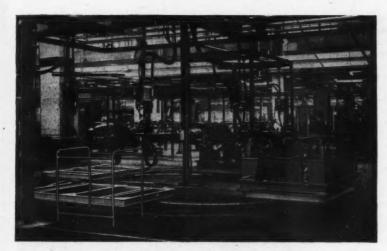


Fig. 13. EView of the roundabout for final welding operations on roof subassemblies for the Aronde car. Four trolleys move on a track, and are fitted with welding jigs, two of which are seen in position

spot-welding operations performed. Subassemblies for 2-door cars are transferred to a series of single-station jigs, which provide for similar operations, and are located at one side of the department. While the sub-assemblies are suspended from the inclined racks, the reinforcing strut in each windscreen opening is removed by an operator, using hand shears.

ROUNDABOUT FOR WELDING OPERATIONS

Fig. 13 is a general view of the welding roundabout for roofs for 4-door cars. A closed loop of conveyor chain

runs in a guide channel, which, in plan, takes the form of a square with short straight sides and large rounded corners. The channel is supported on brackets, anchored to the shop floor, and on either

material to the main roof component, using a press at one side of the station. At the front and rear of the welding jig, there are heavy-duty swinging members, as at R, which engage the inner rein-

forcing frames to locate them correctly relative to the main sub-assembly. To prevent distorthese tion. swinging members are retained in the position shown until inner reinforcing frames have been tackwelded to the windscreen and rear window surrounds, but are then swung outwards, clear of the working zone, to unrestricted permit access for completion of the spot-welding operations.

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Roof sub-assemblies removed from the jig are transferred to inclined racks, and the sub-assemblies for 4-door cars pass to the loading position of a "round-about" equipped with trolley jigs, whereon further assembly and

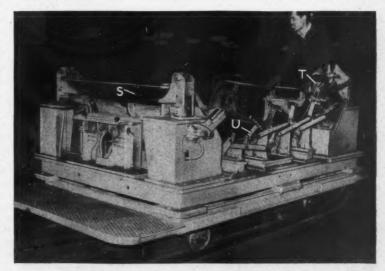


Fig. 14. One of the trolley-mounted jigs for the final welding operations on roof sub-assemblies. Manually-operated and pneumatic clamps are used, and the air supply is connected by means of a quick release coupling which is provided at the loading station

side of it there are steel tracks for the trolleys whereon the welding jigs are mounted. There are four trolleys, and in Fig. 13, jigs are mounted on only two. A framework of steel sections, supported on stanchions above the roundabout, serves to carry the runners from which the SIMCA-built spot-welding units are suspended, also the associated Sciaky welding transformers.

One of the trolley jigs is seen in Fig. 14, and it will be noted that the roof sub-assembly is loaded in the inverted position. A combination of pneumatic and manual clamping is employed, and the pneumatic clamps are of the self-sustaining type, the compressed air supply being connected to each trolley jig, by means of a hose with a quick release coupling, as it reaches the unloading and loading station. After the roof subassembly has been located in the jig, a reinforcing cross-member is assembled behind the cross-member of the windscreen surround. The reinforc-

ing member has two groups of four studs, welded to its front face, and these studs (as may be seen at S) pass through the holes pierced on the hydraulic-



Fig. 16. At the end of the finishing line there is a conveyorized infra-red oven for the application of bituminous sound-deadening material to the interior of the roof panel

ally-operated fixture, Fig. 10. When this member has been assembled, the air clamps are applied, and those at the front end of the fixture serve to

hold the reinforcement in position at each end, in addition to securing the roof sub-assembly.

Side reinforcements for the upper portion of the door opening are prepared in a section at the side of the roundabout, which is equipped with a multipoint spot-welding machine. These reinforcing members are fed to the loading station of the roundabout, and one is assembled to each side of the main roof sub-assembly, the end of such a member being indicated at T in Fig. 14. As the trolley moves from the loading station, the five toggle clamps (as at U) at each side of the jig are applied to secure the reinforcing member in position.

There are two operators at each station of the roundabout, and at the first station, the front and side reinforcing members are tack-welded in position. Welding is completed at the second station, and at the third, a gusset plate is assembled to each front corner of the roof, and secured by oxy-acetylene welding.



Fig. 15. A view of the starting end of the finishing line for roof sub-assemblies, showing the welding of roof gutters with Sciaky portable seam welding tools

ROOF FINISHING LINE

When each trolley jig returns to the unloading/loading station of the roundabout, the roof sub-assembly is released, and is transferred to a chain conveyor, whereby it is delivered to the head of the finishing line (V, Fig. 2). This line has a double chain conveyor track, which is raised above floor level so that the work is at a convenient height for the operators at each side. A view of a station at the head of the conveyor is given in Fig. 15, and the supporting arrangements for the work may be seen. Beams spanning the conveyor chains are fitted with steel fork pieces, and the roof sub-assemblies are loaded so that the cross-members at the front and rear rest in pairs of forks.

Fig. 15 also shows the first operation performed on the line, which provides for seam welding along the gutter at either side of the roof. Sciaky portable welding equipment is employed, and each unit has two disc-type electrodes, one of which is traversed along the inside of the channel section of the gutter, the other being thrust into contact with the flange around the door opening. The welding units are suspended from self-coiling reels attached to framework at each side of the line, and this framework also supports the associated trans-

formers Similar supporting arrangements are provided along the remainder of the line for the portable electric tools employed for the scurfing and dressing operations, which are carried out at the remaining stations.

The end of the finishing line adjoins a second conveyor which passes through a large infra-red oven. Roof sub-assemblies are loaded on to this conveyor in the inverted position, as may be seen in Fig. 16, and are supported by formed lengths of steel rod, as at V, which are welded to brackets on the crossbeams of the twin conveyor chains. These lengths of rod are engaged by the roof gutter, at either end, and the curved portions of the rods roughly locate the roof sub-assembly endwise.

Before the sub-assemblies enter the oven, sheets of bituminous sound-deadening material are placed on the interior surface of each roof panel, as may be seen at W. During the passage of the sub-assemblies through the oven, the material softens and adheres to the panels. The sub-assemblies are allowed to cool on the conveyor beyond the oven, and are then unloaded and transferred to the berceau, as has already been mentioned.

Operations on other body sub-assemblies will be considered in a further article in this series, to be published shortly in MACHINERY.

Warco 1,000-ton Press Brake

In the accompanying figure is shown a weldedsteel, double back-geared, twin-drive press brake,

of 1,000 tons capacity, which was designed and built by the Warco Division of the Federal Machine & Welder Co., Warren, Ohio, U.S.A., for one of the leading aluminium companies.

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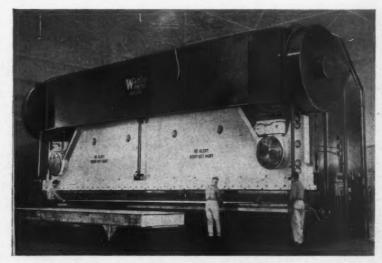
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The welded steel frame components are keyed and bolted, and the bed, slide, and crown are of box construction.

Stated to be among the largest of its type yet built, the machine has a 41-ft. long ram slide with a face width of 6 in., and the stroke is 9 in. Individual adjustments can be made to the ram connections, for forming tapered parts.

The operating speed is 12 strokes per min., and the drive is transmitted through a Warco pneumatically-operated clutch and brake unit arranged for electrical control.



Warco 1,000-ton press brake built by the Federal Machine & Welder Co.

New Red Ring Inspection Equipment for Gears

In the accompanying illustrations are shown some recent additions to the Red Ring range of inspection equipment for gears made by the National Broach & Machine Co., Detroit, Michigan, U.S.A. Precision Gear Machines & Tools, Ltd., Red Ring Works, Bodmin Road, Coventry, is an associate company of the National Broach & Machine Co., and was established for the purpose of manufacturing and selling Red Ring products.

On the rolling gear testers, type GRH, shown in Fig. 1, and type GRJ, in Fig. 2, the master gear is mounted on a shaft which can swivel on a ball-bearing pivot, and is held in mesh with the gear to be checked by an adjustable spring. The minimum centre distance obtainable between the master gear and the workpiece gear is 1% in., and the maximum distance is 12% in. on the type GRH tester, and 121% in. on the type GRJ. A motor drive can be provided, to ensure that the gears are

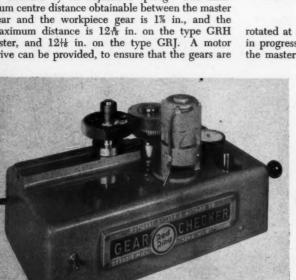


Fig. 1. Red Ring type GRH rolling gear tester

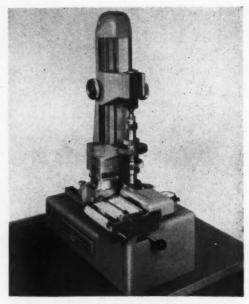


Fig. 2. The Red Ring type GRJ rolling gear tester is here shown set up for checking one element of a cluster; gear

rotated at a constant speed, and when checking is in progress, movements of the shaft which carries the master gear, resulting from errors in meshing,

are shown on a large-diameter dial indicator.

Intended for checking gears with integral shafts, the type GRJ tester is shown fitted with a new recording unit of the paper strip type, which can be brought into operation when the master gear is driven at a speed of about 4 r.p.m. A recording unit of similar design can be provided for the type GRH tester, and both instruments can be fitted with signal lamps which are automatically lit when the movement of the shaft which carries the master gear exceeds the maximum permissible amount. The type GRJ tester is shown set up for checking one element on a cluster gear, and the column, which carries the tailstock for supporting the upper end of the work, can be adjusted in a T-slot in the base to give the required centre distance between the master gear and the workpiece. Other types of work

support arrangements can be provided to suit requirements.

AN INVOLUTE TESTER FOR GEAR SHAVING CUTTERS

The type PCB involute tester shown in Fig. 3 is particularly intended for checking gear shaving cutters with base circle diameters from 5 to 13 in., to a high decree of accuracy. The stylus finger on the measuring head can be swivelled through 180 deg., and deviations from the nominal involute shape on both flanks of each tooth on the cutter are shown on separate large-diameter dial indicators. When checking is in progress, a straight-edge on the roller-mounted slide which carries the measuring head is traversed in contact with a base circle disc, and the amount of movement is shown on a dial type indicator. An electronic recording unit of the rectilinear type is fitted, which enables graphs of both flanks of three cutter teeth to be marked side-by-side on 6-in. wide paper strip. The length of the chart in relation to the traverse movement imparted to the measuring slide, is in the ratio of 10 to 1. The work-head can be adjusted in rectangular-section guideways on the base, and the gear to be checked is accurately located by a ball-bearing bush on the spindle, and is secured by a spring-loaded C-washer.

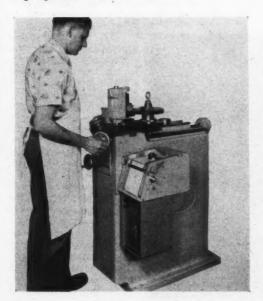


Fig. 3. Red Ring type PCB Involute tester for gear shaving cutters

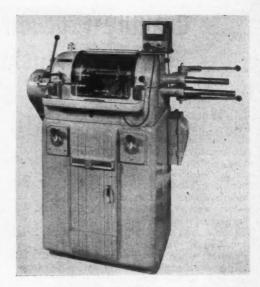


Fig. 4. Red Ring type GSC gear speeder fitted with a microphone, an amplifier, and a dial-type meter

GEAR SPEEDER WITH A NOISE INDICATOR

In Fig. 4 is shown a type GSC 10-in. gear speeder, fitted with a microphone, a broad-band amplifier, and a dial-type meter, instead of the horn which is usually provided, to facilitate checking gears for noise when they are run in mesh. The machine should be operated in surroundings which have a lower ambient noise level than that expected for the gears to be tested. For setting up, two master gears are run in mesh, and the meter is adjusted to give a reading, which corresponds to the resulting noise level.

It should be noted that the type GSC gear speeder described above will not be available for supply through Precision Gear Machines & Tools,

Ltd., until July 1, 1961.

A THERMIONIC EMISSION ELECTRON MICROSCOPE, it is reported, has been developed by the Physics Department of the General Motors Research Laboratories, Detroit, U.S.A., to permit observation of the behaviour of metals at high temperatures. Samples can be observed, at 3,000 × magnification, on a viewing screen, as they are heated in a built-in furnace, and changes in microstructure at different temperatures can be noted.

Quantity Production of Laminations for Transformer Cores

LAMINATIONS FOR TRANSFORMER CORES, in a wide variety of sizes and designs, are being produced in large quantities by the Transformer Department of Ferranti, Ltd., Hollinwood, Lancashire, with the aid of a special fully-automatic installation which has recently been put into operation. The equipment, of which a general view from the delivery end is shown in Fig. 1, is akin to a transfer press and has an overall length of 60 ft. It was designed and developed by Ferranti, Ltd., and the press sections were supplied by A. Kinghorn & Co., Ltd., Todmorden, through their principals Rushworth & Co. (Sowerby Bridge), Ltd., Yorks., and to Ferranti specification. The associated feed mechanism and press automation were supplied, to Ferranti specification, by Humphris & Sons, Ltd., Poole, Dorset, and the tooling was built by The Norbury Engineering Co., Ltd., Hyde, Cheshire. Ferranti, Ltd., supplied all the remaining auxiliary equipment.

The special cold-rolled grain-orientated steel employed for the laminations is fed to the installation from coil, having been cut to the required width on the special rotary slitting machine shown in Fig. 2. Coil stock is fed from a unit behind this machine (not shown) and after passing through the slitting knives it is re-coiled on the unit seen in the left foreground. This equipment will handle coil stock in reels weighing up to 3 tons, and with widths from 3½ to 36 in., and a maximum of eight separate strips can be cut at one pass.

Coils of steel of the required width are transferred to the Humphris uncoiling unit seen in Fig. 3, which is a close-up view from the entry end of the installation. The leading end is taken from the coil and is passed over and under the swinging roller A, and thence to the feed roller unit in the background. At this stage, the installation is under the control of a foot-operated switch, and the leading end of the strip is fed through until it is just beyond the first press tool. This tool is then operated, to pierce a number of holes and to crop the leading end at an angle of 45 deg. The scrap from the latter operation is then removed, and the control of the machine is transferred to

"automatic".

The strip is then advanced over the second set of piercing and cropping tools to trip the hydro - pneumatic press shown on the bed extension in Fig. 4. This unit provides for applying a back-tensioning action to the strip, as will be explained later, and serves to operate the main press. At this stroke, the first tool pierces holes in the blank portion of the strip and a cropping tool severs it from the stock. The second tool simultaneously severs the leading lamination from the strip, and with this arrangement, two complete laminations of regular 45-deg. trapezium form are produced for each stroke of the

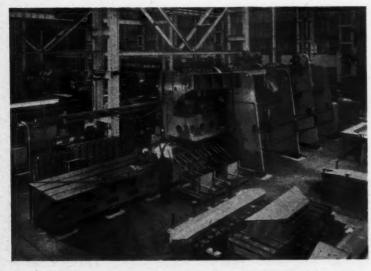


Fig. 1. General view, from the delivery end of equipment installed in the Transformer Department of Ferranti, Ltd., Hollinwood; for the quantity production of laminations for transformer cores



Fig. 2. This rotary slitting machine trims the coil stock to the required width for use on the installation shown in Fig. 1

machine. It is arranged that the leading lamination is delivered to the left-hand side of the machine, looking in the direction of transfer, and the second lamination to the right-

hand side.

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A close-up view of the second press station is shown in Fig. 4. As the leading end of the stock passes beneath this tool it interrupts the beam of light from the transmitter B, which is part of a photo-electric cell system. As it approaches this beam, the strip is being fed at the rate of 200 ft. per min., but when the beam is obstructed the feed rate is automatically reduced to 6 in. per min. The strip proceeds at this rate until the leading end strikes a micro-switch housed within special pneumaticallyoperated punch unit C. This unit serves punch a small-diameter "anchor" hole, near to the leading edge of the strip, and the punch slide is arranged to stop in the downward position, so that the tool remains in engagement with the material.

Operation of the unit C also serves to close circuits whereby the main feed rolls are opened, to release the strip, and another pair of rollers is closed, to grip This latter pair of rolls is arranged to be driven in the opposite direction, as compared with the feed rolls, and as a result the strip is pulled lengthwise, in tension, against the punch in the unit C, which acts as an anchor. This lengthwise tensioning serves to remove any

undulations in the stock, and is continued until a clutch unit in the drive to the tensioning rolls starts to slip. This latter slip serves to actuate a

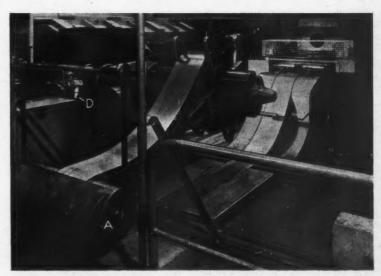


Fig. 3. Close-up view of the Humphris uncoiling unit at the entry end of the lamination machine

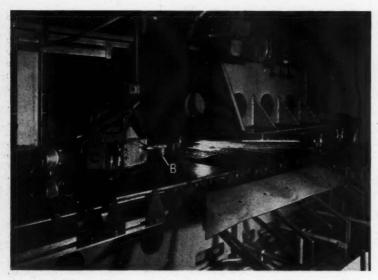


Fig. 4. In this close-up view of the delivery end of the installation, a finished lamination is seen being discharged from the final press tool

hold-down ram in the feed roll assembly, which grips the strip and maintains the lengthwise tension. The reverse drive rolls are then brought to rest and are returned automatically to the idle position.

The press tools are then lowered, to perform the piercing and cropping operations described above, and as they rise the punch in the unit \mathcal{C} is also withdrawn and ejector mechanisms are actuated. As a result, the laminations are delivered from the machine as described previously. A lamination which has just been ejected can be seen in the right foreground in Fig. 4, and the arrangement is such that it slides down a number of inclined cylindrical bars.

From the ends of the bars, the lamination falls flat, on to a wooden pallet, and when a stack has been built up, the pallet is removed and a fresh unit is substituted. A number of these wooden pallets, with stacks of laminations in position, can be seen in the temporary storage area in the foreground in Fig. 1.

Another photo-electric cell system is employed in connection with the uncoiling unit seen in Fig. 3. As the stock is drawn into the machine by the feed rollers, the swinging roller A moves in an anti-clockwise direction, and is thereby removed from the path of a beam of light from the unit D. As a result, a circuit is completed to start the drive motor of the un-coiling unit, and more stock

is delivered from the coil. Consequently, the arm A swings back to the position shown, and the beam of light is interrupted, thereby stopping the motor of the uncoiling unit.

It may be noted that this installation for piercing and cropping laminations also includes provision for the removal, by grinding, of burrs, caused by these operations. An important advantage offered by this installation is that the various press operations are located in relation to the centre line of the strip, which is coincident with the centre line of the finished core assembly. With this arrangement, any manufacturing errors are halved,

instead of being displaced to one side as was the case when—with the method employed hitherto—pre-cut blanks were located in the press tools from two mutually perpendicular edges. As a result, a considerable increase in the accuracy of the finished laminations has been obtained.

ZIRCON MOULDING SAND.—A recent issue of Firth Brown News includes an abridged version of a prize-winning paper delivered by Mr. B. W. Midgley to the Lincolnshire Iron and Steel Institute, and it is interesting to note that zircon sand is now being used almost exclusively for moulding castings between 1 and 7 tons at the Scunthorpe foundry of Thomas Firth and John Brown, Ltd. It is stated that steel castings are removed from the moulds more easily, and in a much cleaner condition, being almost entirely free from adhering sand.

Although zircon sand is more expensive than the Sheffield Compo it replaces, an advantage is gained from the fact that it can be employed in layers only about %th as thick as are required when Compo is used. Zircon can be stoved at 200 deg. C., as compared with 500 deg. C. for Compo, and savings result from the elimination of the heavy chipping and dressing which are required to clean-up castings which have been poured in Compo moulds.



Transistor Production in Japan*

Methods Employed by the Tokyo Shibaura Electric Co., Ltd.

By R. E. GREEN, Associate Editor

ONE OF THE LARGEST companies engaged in electrical manufacture in Japan at the present time is the Tokyo Shibaura Electric Co., Ltd., whose head office is at 2, Ginza Nishi 5-chome, Chuo-ku, Tokyo. This company had its origin some 86 years ago, when a small workshop was established in Tokyo by Hisashige Tanaka, for the manufacture of Henry-type telegraph instruments. The business, later known as Shibaura Engineering Works, continued to develop and expand, and in 1939 it was merged with the Tokyo Electric Co. and the present title was adopted. This title has since been popularly shortened to Toshiba, which is one of the firm's trade marks.

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Some years prior to the merger, the Shibaura Engineering Works had built a large factory at Tsurumi on the edge of Tokyo bay, about half-way between Tokyo and Yokohama. Great damage was caused to these works by bombing, but recovery after the war was comparatively rapid, and by 1947 the factory was capable of producing a 1,000-h.p. Koepe-system electric winding machine for mining operations. By 1959, the company had a capital of about £25 million and a total of 19 factories and was engaged in the manufacture of almost every type of electrical machine and appliance from transistors to generators weighing up to 100 tons.

In addition, the company maintains two research laboratories, one engaged in work on heavy-current machines, and the other on light-current appliances and instruments. Some 40,000 people are employed, and the value of the company's products is about £90 million per year.

In addition to its own plants, the company controls those of more than 50 other firms concerned with many fields of activity, and has technical collaboration agreements with 16 manufacturers in Great Britain, U.S.A., West Germany, France and the Netherlands.

TOSHIBA TRANSISTOR WORKS

As is widely known, the growth in application and in the numbers of transistors produced in Japan, since they were introduced in the U.S.A. in

^{*}Articles on the Japanese metal-working industries which have already been published in Machinery have been concerned with the 4th Osaka International Trade Fair, 96/1212—1/6/60 and 96/1284—8/6/90; Motor Car Production in Japan, 96/1426—15/6/60, 96/1552—22/6/60 and 96/12640—26/6/60; Bicycle Production in Japan, 97/40—6/7/90; Refrigerator Production in Japan, 97/410—24/8/60, 98/170—25/1/61; Electric Motor Production in Japan, 97/708—28/9/60, 97/1276—7/1260 and 97/1448—28/12/60; Television Receiver Production in Japan, 97/982—26/10/60; The Machine Tool Industry of Japan, 97/108—13/7/60; Japanese Machine Tool Factories, 1. Ikegai Iron Works, Ltd., 97/304—10/8/60, 2. Okuma Machinery Works, Ltd., 97/9472—31/8/60, 3. Toyoda Machine Works, Ltd., 97/52—21/9/60, 4. The Kawasaki Works of Hitachi, Ltd., 97/1048—9/11/60.



Fig. 1. The new Toshiba factory, for the production of transistors at the rate of 5,000,000 per month, is mainly of windowless construction and is air-conditioned

1948, has been phenomenal, and the manufacture of electronic equipment incorporating these devices has also expanded very rapidly. This growth has been encouraged by the Japanese Government,

which saw in the industry an outlet for the inherent skill of the Japanese people. In this connection it may be noted that the output of the electronics industry in Japan in 1959 was valued at about £330 million, or some 80 per cent more than in the previous year, and it is believed that when the figure for 1960 is available it will show a further rise to about £430 million.

The Toshiba company was one of the first concerned with the development and production of transistors, which were made at their Yokosuka factory, near Tokyo, in 1956. These transistors were used in small portable radios made at the

Yanagicho works, which has a capacity of more than 100,000 per month, and also produces watthour meters, refrigerators and other household equipment. In 1957, the company began the construction of a large new factory, which was specially designed for the mass production of transistors and other semi-conducting devices, and had an initial output rate of 2,000,000 per month.

A general view of this factory is given in Fig. 1, and it is built on a site near the Komukai communication and electronic equipment factory, which is seen in the background, at Kawasaki, alongside the

trunk road from Tokyo to Yokohama. The site area is about 430,000 sq. ft., and the factory has four floors which provide a total of 314,000 sq. ft. Completed towards the end of 1958, the building



Fig. 2. View inside the control room for the air-conditioning plant in the Toshiba factory. Instruments provide for monitoring and controlling temperature, humidity, and the concentration of dust particles in incoming air

incorporates the most modern ideas relating to transistor production, and has no windows above the ground floor, lighting being provided by fluorescent tubes of the companys own manufacture.

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All the production areas, which comprise the second, third, and part of the fourth floors, are supplied with specially-treated air in order to provide suitable conditions for the operations in progress. Under the control of the fully-instrumented semi-automatic installation in the room shown in Fig. 2, this air is pumped into the production shops from an auxiliary building placed between the wings of the U-shaped factory, by means of two 800-h.p. compressors, the plant being designed to provide a complete change of air every 15 min. Before entering the building, the air is heated or cooled to a temperature of 25 ± 1.5 deg. C. (77 ± 2.7 deg. F.), and the humidity is reduced to less than 45 per cent. Filters through which the incoming air is passed are designed to

reduce the number of dust particles of a larger size than one micron (0·00004 in.) from 90 per c.c. in the outside air to 22.

From the upper floors, the out-going air passes down to the ground floor where it is circulated through the administrative offices, laboratories, and special machine building shops, before leaving the building. Entrances to each of the "clean air" production shops are provided with double doors at the ends of short narrow corridors. Only one door of each pair can be opened at a time, and jets of clean air are directed on to the clothes of entrants as they pass through the corridor to remove any loose dust particles. Special overalls, which are regularly washed by the company's laundry, are issued to all workers.

A total of about 2,800 people is employed in the factory, of whom some 72 per cent are female, mainly from 16 to 25 years of age. These girls are recruited from Tokyo and other large towns nearby, and from less densely populated districts. Girls who come from long distances are accommodated in specially-built dormitories in which they live three to a room measuring about 9 ft. square, in buildings which provide for about 530 beds. The girls are paid about £8 per month at the start of their training, and can usually double this figure by the end of the normal period of 10 years, by which time they either marry or move to other types of employment.



Fig. 3. Typical of the equipment developed by the company for the production of transistors are these high-frequency heated, zone-refining furnaces, through which ingots of germanium and silicon are passed

Two shifts of 7½ hours each are worked per day, for a 6-day week, and there is a canteen in the works where a mid-shift meal can be obtained for the subsidized price of about 7½d. The first shift starts at 5.45 a.m. and continues until 2 p.m., with a 45-min. break, and the second shift is from 2 to 10 p.m., with a 30 min. break.

PLANT AND QUALITY CONTROL

During the period when transistors were being produced in the Yokosuka factory, considerable development work was carried out on production methods and many special machines were designed These machines provide benefits in two ways, of which the less important is said to be the reduction in cost which is obtained from the use of special-purpose automatic equipment. The main benefit is the improvement in the standard of quality which has been made possible by the elimination of the human element from production operations, and many of the processes in the factory are now only supervised by the workers. It may be noted that, whereas the planned output of the factory, when it was first built, was 2,000,000 transistors per month, this level was soon reached, and at present some 5,000,000 transistors, representing about 40 per cent of Japan's total output, are made per month.

Most of the design and development work on

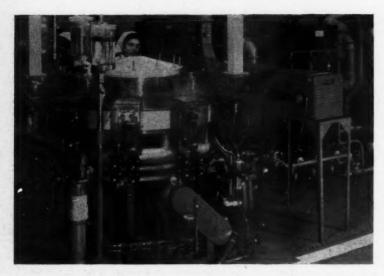


Fig. 4. This special machine is designed to perform etching and rinsing operations on germanium wafers on a semi-automatic cycle, supervised by the operator seated at the far side

special machines and processes is undertaken on the ground floor, to which earlier reference was made. Here some 85 people are employed, including 17 graduate engineers, in an area of about 10,000 sq. ft. The factory administration also includes a large quality control organization which covers every stage of production from raw material through the manufacture of parts to their assembly into complete transistors. So high are the requirements for reliability in the completed product that it is now found that further improvements can only be achieved by the use of more and more fully automatic machines.

In addition to the sections concerned with the design of special plant, laboratories—including a low-temperature laboratory in which temperatures down to -270 deg. C. can be obtained—are provided on the ground floor. Here, new types of transistors and semi-conducting devices are developed, including thermistors and phototransistors for entertainment and industrial applications of various types.

PRODUCTION OF TRANSISTORS

Because most of the special-purpose plant is of original Toshiba design, the company is not willing to allow detailed descriptions to be published, and the following references are therefore necessarily brief. In general, the methods employed for the production of transistors do not differ noticeably from those employed in the West, since the raw materials and the end products are so similar. Zone refining methods are employed for

germanium and silicon, and typical furnaces for this operation are seen in Fig. 3, the process being semi - automatic. The metal is carried through induction heating coils which produce molten zones wherein impurities are suspended, and thus

caused to migrate to one end of the ingot.

After the ingots have been re-melted and subjected to a "crystal-pulling" process which produces the required crystal orientation, they are



Fig. 5. Part of a row of 10 thickness sorting machines in which germanium wafers are checked for thickness and sorted into 10 grades within the tolerance of 9 microns

Fig. 6. In these transfer testing machines, transistors, introduced at the right-hand end, are carried automatically to various testing positions and rejected into chutes at the sides if they are defective

sliced on special machines, with the aid of diamond-impregnated wheels, to obtain wafers of various thicknesses according to the requirements of the transistors to be made. Lapping machines are employed to reduce the thickness of wafers, and they are

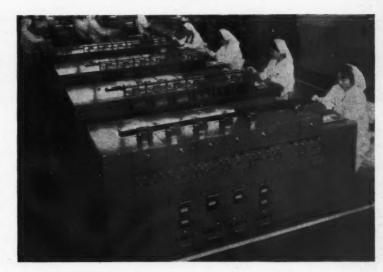
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also etched to obtain further thickness reduction, and to smooth the surfaces, on special machines of the type shown in Fig. 4. This machine performs a controlled cycle of etching and rinsing operations on wafers which are fed in by the operator seen



Fig. 7. This semi-automatic press, for the assembly of transistors to their protective caps, is tended by two operators, and has a cycle time of 7 sec.



seated at the far side of the machine structure.

Wafers are subsequently sorted into thickness grades, within an overall tolerance which may, for example, be 9 microns (0.00036 in.). Wafers within this tolerance are divided into grades on fully automatic machines of the type seen in Fig. 5. The wafers are fed from a hopper, one at a time, and pass beneath a gauging head, which determines the setting of shutters in a receiving chute, at the rate of 40 per min. Wafers of similar grades are thus segregated, and counters on the tront of the machine record the number of each The grades are separated by steps of 1 micron (0.00004 in.), and compartments are also provided for wafers which are too thick and too thin to be acceptable. There are ten similar machines in the row illustrated, which is one of several in the factory.

Alloying operations, whereby a pellet of indium is placed on one or both sides of the wafer and melted into it are also performed on special automatic machines, and testing is subsequently carried out to check the electrical characteristics, on equipment such as that shown in the heading illustration. Automatic transfer testing machines are used at a later stage, as shown in Fig. 6, for checking the assembled units. Transistors are fed in at one end of such a machine and carried automatically to a number of stations at which different tests are performed. Those transistors which fail to pass a particular test are ejected automatically into chutes alongside the testing position.

Most of the transistors produced by Toshiba are

enclosed in caps or containers drawn from German

silver sheet material, coated with cold solder, and this operation also is performed on special machines, one of which is seen in Fig. 7. This machine operates on a 7-sec. cycle, and two seated operators are employed to load the caps and the transistor assemblies into fixtures carried on the automatic indexing table. On the table, the assemblies are carried past an automatic press,

the operations of which are synchronized with the indexing movements.

Articles describing methods and equipment employed in other Japanese metal-working plants, including the factories of machine tool builders, will be published in forthcoming issues of MACHINERY.

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Scrivener Loading Attachment for a Centreless Grinding Machine

To avoid the risk of workpieces being accidentally dropped between the wheels on a centreless grinding machine during manual loading and unloading, Arthur Scrivener, Ltd., Tyburn Road, Birmingham, 24, have equipped one of their No. 3 grinders with an attachment which enables these operations to be performed at one side of the grinding zone. This attachment may be seen in the close-up view Fig. 1. The set-up is employed for plunge-grinding, simultaneously, surfaces at both ends of the worm-shaft illustrated in Fig. 2,

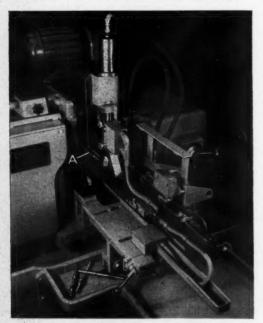


Fig. 1. Mounted on a Scrivener No. 3 centreless grinding machine, this transfer attachment enables workpieces to be manually loaded and unloaded at one side of the grinding zone

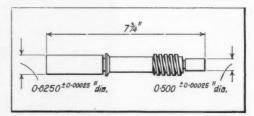


Fig. 2. Surfaces at both ends of this worm-shaft are ground simultaneously

the machine being fitted with twin grinding and control wheels.

In operation, the workpiece is loaded, with the axis parallel to those of the wheel-head spindles, on a cradle at the lower end of a vertical carrier bar, as shown at A in Fig. 1. A shield ensures that the part is admitted only when it is correctly orientated, and it is lightly clamped by a gravity-loaded plunger housed vertically in the carrier bar. The width of this bar is such that the work projects at either side, the portions to be ground being entirely clear.

During the automatic cycle, which is initiated by means of a push button, the carrier is traversed towards the grinding zone, by horizontal movement of the cranked arm on which it is mounted, until the workpiece occupies a position directly above the work-plate, with the areas to be ground aligned with the wheels. A hydraulic cylinder is then brought into operation, to lower the carrier until the workpiece is supported on the plate. Grinding is performed automatically, in a cycle time of 17 sec., and after completion of the operation and retraction of the control head, the carrier is raised and then traversed away from the working zone. The finished part is thus returned to the original position, in readiness for unloading.

EXPORTS OF MACHINERY, other than electric, to Brazil totalled £7,377,379 in the 11 months ending November 30, 1960. For the same period of 1959, the total was £3,225,389.

NEW PRODUCTION EQUIPMENT

Edited by G. W. Mason and

A. J. Barker

Webster & Bennett Type EH Vertical Turning and Boring Mill

The range of vertical turning and boring mills built by Webster & Bennett, Ltd., Northey Road Works, Foleshill, Coventry, which is marketed in the U.K. by Wickman, Ltd., Factored Machine Tool Division, Fletchamstead Highway, Coventry, has been extended recently by the introduction of a type which has vertical adjustment for the crossrail. Designated EH, this machine is available in sizes which have 4-jaw, independent chucks of 36, 48 and 72 in. diameter. Work up to 46, 58 and 84 in. diameter can be swung, and the maximum distance obtainable between the chuck surface and the underside of the cross-rail is 40 in. on the smallest machine and 48 in. on the larger sizes. In Fig. 1 is shown the largest of the new machines, and Fig. 2 is a close-up view of the machine setup for taking a facing cut on a chemical vessel.

The heavily-ribbed bed and column are cast integral, to ensure the necessary rigidity for taking heavy cuts, and the chuck is mounted on a hollow spindle, which facilitates chip removal and permits the use of a boring bar. Drive is taken through V-belts and a multi-plate clutch, and 12 speeds for the chuck can be selected by means of direct-reading dials, changes being made hydraulically. There is a choice of five ranges, the lowest of which is from 1.9 to 41.5 r.p.m., and the highest, from 4.5 to 100 r.p.m. Final drive to the chuck is transmitted through a pinion and a large gear ring.

All the slides have long guiding surfaces, and taper gibs are provided. Drive for vertical adjustment of the cross-rail on the column ways is taken from a separate motor. On the machine in Fig. 1, the turret saddle may be traversed outwards, from a position co-incident with the chuck centre, for a maximum distance of 51½ in., and the vertical travel of the turret slide, which may be swivelled to either side of the vertical position, is 38 in. The turret saddle may be set to permit turning operations to be carried out at diameters up to the maximum which can be swung. Boring can be performed to a depth corresponding to the total travel of the turret slide only when the diameter

thus machined exceeds 35 in. and, for smaller bores, the maximum depth is 28 in.

There are 12 feed rates for the turret saddle and slide, which are selected and changed in the same manner as described in connection with the chuck. A separate motor provides for rapid traverse of these slides. The forged steel turret is located, after indexing, by a quick-acting, positive arrangement, and a powerful clamping mechanism is incorporated. It is normally of the hand-operated type, but a power-operated turret, as described in MACHINERY, 96/1457—22/6/60, can be fitted if required.

Controls for the selection of speeds and feeds, and the operation of the various motors, are grouped together at the right-hand side of the machine, and the electrical equipment is housed in a compartment at the rear. Floor space of 12 ft. 8 in. by 10 ft. is required, and the weight, exclud-

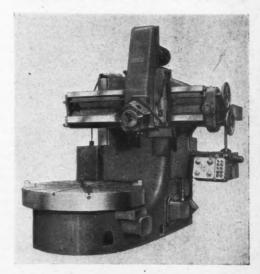


Fig. 1. Power vertical adjustment is provided for the cross-rail of this Webster & Bennett type EH vertical turning and boring mill



Fig. 2. Close-up view of the Webster & Bennett turning and boring mill set up for machining a chemical vessel

ing the electrical equipment, is approximately 13% tons.

All the attachments designed for use with the company's fixed cross-rail boring mills can be employed with the new machine, and it can be supplied with built-in electronic profiling equipment.

D-Burr Gear De-burring and Chamfering Machine

Built by Burrows & Smith, Ltd., Leicester, the D-Burr machine shown in Fig. 1 is primarily intended for de-burring and chamfering the teeth on a wide variety of gears up to 12 in. diameter, although these operations may also be performed on other components such as ratchet wheels and sprockets. Sole agents for the machine in the United Kingdom are Alfred Herbert, Ltd., Factored Division, Red Lane Works, Coventry.

In operation, a gear is mounted on the spindle of the work-head, which is then swung upwards about a horizontal pivot, by means of a lever, to an intermediate position, as shown in the close-up view Fig. 2, with a number of the teeth engaged between helical ribs on the periphery of the grinding wheel. This position is adjustable and is

determined by means of a heavily spring-loaded ball. Next, the grinding head motor is started, and the work-head is swung upwards, against the spring pressure, to bring the work to a second position against a dead stop. While the operation is in progress, the ribs serve to rotate the work, and during one complete revolution, chamfers are ground on the edges of the full profiles of the teeth, on one side of the gear. After grinding has been completed, the motor is switched off and a magnetic brake is automatically applied to stop the wheel spindle, and the work-head is returned to the original position. The gear is then inverted, and the cycle repeated for de-burring the teeth on the opposite side. As an example of the output obtainable, it is stated that when chamfering both faces of a 30-tooth 8 d.p. gear, the floor-tofloor time is 15 sec.

For de-burring helical gears, the head may be swivelled through a maximum angle of 30 deg, in either direction, and an attachment is available that enables bevel gears to be handled. Provision is made for transverse adjustment to enable the

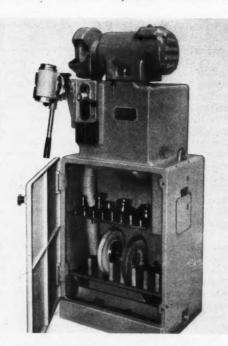


Fig. 1. This Burrows & Smith D-Burr machine can be employed for de-burring and chamfering the teeth on a wide variety of gears up to a maximum diameter of 12 in.



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Fig. 2. Close-up view of the work-head on the Burrows & Smith D-Burr machine

full face width of the wheel to be utilized, also for vertical adjustment.

Developed the result of cowith operation Norton Grinding Wheel Co., Ltd., the 8-in. diameter by 1%-in. wide grinding wheel employed is supplied ready-formed to suit teeth of a particular size and profile shape. The structure is such re - forming that has after wear taken place is not practicable, but it is stated that very long life is obtained before it is necessary to dis-

card the wheel. Drive to the wheel spindle is taken from a ½-h.p. rotor/stator unit. The entire grinding head may be adjusted towards or away from the work.

Dust extraction equipment is housed in the rear of the machine and it may be noted that the separate motor for this equipment and the grinding head motor are controlled by the same switch. The arrangement is such that the extraction equipment is brought into use before the grinding motor is started.

Lasco Type FP 221 S Electro-hydraulic Press

The latest type FP 221 S electro-hydraulic press from the Lasco range built by Langenstein & Schemann, A.G., Coburg, Bey., Germany, is shown in the illustration. Equipped with an 80-ton capacity drawing cushion, this 220-ton press may be employed for blanking and drawing operations, and, if required, the ram, which weighs 4 tons, can be allowed to fall freely to give a blow of 14,466 ft.-lb. maximum energy, for coining and stamping work. This feature enables planishing to be carried out following drawing, at the same setting, so that flanges and other portions of the work can be accurately flattened.

The ram has a maximum travel of 31½ in., and the drawing cushion, a working stroke of 17¾ in.,

a maximum daylight of 55 in. being obtainable. When the working stroke has been completed, the ram is returned to the top of its travel under a force of 22 tons, and a force of 12 tons is applied upwards by the drawing cushion, for ejecting the work. The maximum force to be applied by the ram and the drawing cushion can be pre-set independently by levers on the separate, floormounted hydraulic unit, and the working speed and the direction of travel can be controlled, during the operating cycle, by other levers built into the right-hand side member of the frame. Alternatively, movements of the ram and drawing cushion can be controlled electrically by pushbuttons, mounted on another free-standing unit. If required, moreover, the press can be pre-set for an automatic cycle comprising from 1 to 5 ram strokes.

The steplessly-variable ram speeds available range from 69 to 72 ft. per min. for rapid approach, and from 7 to 8½ ft. per min. for the working portion of the stroke. Pressure oil for operating the ram, the drawing cushion, and the control system is delivered by separate pumps, driven by motors of 44, 13½, and 5½ h.p. The top face of the bed measures 39% by 63 in., and the end surface of the ram, 39% by 55 in.

Presses of similar design are available in capaci-



Lasco type FP 221 S electro-hydraulic press

ties from 75 up to 500 tons, which provide maximum blow energies for coining and stamping ranging from 2,880 to 20,160 ft.-lb.

Paul Granby & Co., Ltd., 39 Victoria Street, London, S.W.I, are the distributors in this country for Lasco presses.

Optical Measuring Equipment for Kearns Horizontal Boring Machines

Optical equipment can now be supplied by H. W. Kearns, Ltd., Broadheath, near Manchester, for measuring axial travel of the spindles of their series 45 and 72 horizontal boring machines and the No. 2 and 3 patent horizontal boring machines. With a projection screen measuring 4 by 1½ in., the equipment permits movement at a normal feed rate to be read to 0.01 in., and final settings can be made by hand to 0.001 in.

A scale is carried on the upper surface of the housing for the spindle feed mechanism, as shown in the accompanying illustration, and is not subject to wear. An optical unit, which incorporates the projection screen, is secured to and moves with the rear spindle bearing. Graduations on the fixed scale are projected on to the screen, on which vernier markings are provided, and as the vernier and the projected image are on the same face, parallax errors are avoided. A mirror permits readings to be made from the normal operating position. With the rear bearing unit clamped in

one position, spindle movement for a maximum distance of 12 in. can be obtained. If an additional length of traverse is required, however, the bearing can be re-clamped in a different position.

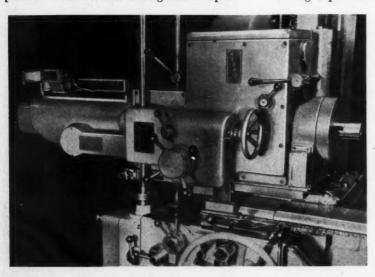
Fine adjustment is provided for the scale, which can thus be set to zero or a whole number division in relation to the optical unit. A pneumatic time switch is incorporated to protect the lamp of the optical system.

Curvit Bending Machines

Funditor, Ltd., 3 Woodbridge Street, London, E.C.1, are now marketing in this country the bending machines built by the Curvit Division of the Maclodyne Corporation, East Providence, R.I., U.S.A. An example is shown in the accompanying illustration from a range of horizontal-type machines, which are intended for forming coils or rings from tubes and a wide variety of other crosssectional shapes. The range includes the No. C 145 machine, as seen in the figure, with which tube up to 1 in. diameter or steel bars of % by % in. can be coiled or formed edgewise to radii which The smallest machine, are steplessly variable. known as the type C 1, will handle tube from % to % in, diameter, and the largest (type C 170) has a capacity for 3-in. diameter tube. Special machines can be supplied for bending tube up to 5 in. diameter.

Bending is performed by a large diameter roll,

which is mounted at the upper end of a vertical shaft at the centre of the circular head, and two smaller rolls. The small roll past which the material enters is mounted on a carrier that may be bolted in various angular positions in relation to the large roll. The bending roll is carried on an arm. which may be swivelled about the axis of the large roll and a small crank handle provides for adjusting the angular position, for setting the bending radius. At the beginning of a bending operation, this arm is swivelled by an air or hydraulic cylinder, thereby thrusting the roll into the pre-deter-



Optical equipment, as here shown, is now available for measuring axial movements of spindles on certain Kearns horizontal boring machines



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Curvit type C 145 universal bending machine for tube and strip material

mined position and initially forming the workpiece. The arm is held in position during the progress of bending, and a maximum thrust of 12,000 lb. in. can be applied on the largest machine mentioned with air at a pressure of 80 lb. per sq. in.

With this arrangement, the machine may be operated by means of push-buttons, to enable bending to start from the leading end of a workpiece, or after a straight portion has been passed through the rolls. Moreover, bending may be interrupted during the passage of the work, for example, when producing parts with intermediate straight portions, or to alter the bending radius. Equipment can be supplied to enable tubes to be formed to rectangular, octagonal, and other shapes in an automatic cycle.

When forming coils, bending in a second plane is obtained by means of a pitching device which permits stepless variation. An air-hydraulic attachment available for the largest machine enables rings or the turns of coils which are made from strip material, and have a minimum diameter of 1½ in. and maximum wall thickness and height of ¾ and 6 in. respectively, to be flanged at angles up to 90 deg. or radiused at either end. The material may also be inclined to a maximum angle of 60 deg., with reference to a plane at right-angles to the axis of the completed part, for forming rings or turns of conical shape. Bending and flanging may be carried out at the same setting.

Drive for the largest machine is taken from a 20-h.p. motor, and is transmitted by means of reduction gearing to the large roll. Spur gear teeth machined on the periphery of this roll, below the profiled portion, engage similar teeth on the small rolls, to drive the latter members.

Known as down coilers, alternative versions of the machines are available, with the axis of the bending head horizontal. With this arrangement, coiled work may be supported, after leaving the tools, on a cylindrical bar, and the completed part may be removed without stopping the machine.

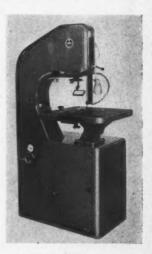
Thiel Type 117 Bandsawing and Filing Machine

Shown in the illustration is the new type 117 bandsawing and filing machine introduced by the German firm of Thiel, who are represented in this country by Rockwell Machine Tool Co., Ltd., Welsh Harp, Edgware Road, London, N.W.2.

This machine has a throat depth of 19% in., and will handle work up to 9% in. thick. The bandsaw blade passes round three guide wheels mounted on ball bearings, and is driven by a variable speed unit from a 1%-h.p. motor, which is controlled by a pedal-operated switch. The steplessly-variable saw speeds obtainable range from 50 to 3,000 ft. per min., and are selected by means of a handwheel in conjunction with a dial-type indicator mounted on the side of the base. A butt welding and annealing unit for joining saw blades, also grinding and guillotine attachments, are housed

behind a door on the upper part of the frame, which encloses part of the blade and two guide wheels. The upper guide wheel can be adjusted vertically for varying the tension on the saw blade.

The 24- by 24in. work-table can
be swivelled
through angles up
to 30 deg. to the
right and left, and
can be tilted
through a maximum of 15 deg. on
each side of the
horizontal position,
by means of racks
and pinions, scales



Thiel type 117 band:awing and filing machine

being provided to facilitate setting. A low-voltage lamp, a magnifying lens, and an air pump and nozzle for blowing cuttings clear of the working area, are provided.

M.R.P. Type W-II A Automatic Universal Spring-coiling Machine

The type W-11 A, German-built Meyer, Roth & Pastor-Torrington automatic universal spring-coiling machine shown in the accompanying figure will produce a wide variety of coiled springs of the compression or tension types, with or without closed ends, and with right- or left-hand windings, also, with the aid of various accessories, cylindrical double or single taper springs, other types of specially formed springs, and plain rings. By means of a special attachment, torsion springs with open or closed pitch windings, and with or with-out straight tails, can also be made, in a wide variety of shapes.

The machine is fully automatic in operation and wire is drawn, from a coil, through the straightening attachment seen at the extreme right. As each spring is completed, it is automatically cut off and ejected and the cycle is repeated continuously. A steplessly-variable drive unit is incorporated, which enables the optimum working conditions for any required gauge of wire, and shape of spring, within the capacity of the

machine, to be readily obtained.



M.R.P.-Torrington type W-11 A automatic universal spring-coiling machine

Wire size may range from 27 to 15 gauge, and the maximum length of wire normally permissible for any one spring is approximately 41% in. Springs ranging from $\frac{3}{32}$ to $1\frac{3}{16}$ in. outside diameter can be wound, and the output ranges from 22 to 180 per min., depending upon the size and complexity. Extra change gears are provided for springs with wire lengths up to a maximum of 7½, 12, and 24 in., also for wire lengths in excess of 41% in. and up to a maximum of 83 in., in certain gauge sizes.

M.R.P. spring-coiling machines are marketed in this country by Soag Machine Tools, Ltd., 7 Juxon

Street, London, S.E.11.

Mattison Travelling Head Grinding Machine for Facing Large Coil Springs

For facing the ends of large coil springs, Mattison Machine Works, Rockford, Ill., U.S.A., have recently built a modified version of their type 500 UK travelling head grinding machine, which is shown in the accompanying figure. There are two working stations, which are arranged side-by-side. The grinding head is mounted on longitudinal ways on a bed member at the rear, and the wheel is rotated in a vertical plane parallel with the direction of traverse. In the figure, the head is

obscured by the guards.

Unloading and loading, and turning the work end-for-end, are carried out alternately at the two stations, while grinding is in progress at the other position. After a workpiece has been located against the fixed stop at one station, it is clamped by an air-powered arrangement, which is brought into operation by push-button. A second pushbutton is then pressed to initiate the automatic During this cycle, the head is grinding cycle. hydraulically reciprocated to pass the wheel across the end of the work, and is finally traversed along the ways to a position opposite the other station, in readiness for the next sequence of operations. With this machine, it is claimed, improved accuracy has been obtained, and it has enabled production rates for springs of two particular sizes to be increased from 10 to 20 and 3 to 74 per hour.

The Mattison type UK grinder is normally supplied with a single T-slotted table, which may have a length of 86 in. or more. Machines of three sizes are available, which are designated series 500, 600 and 700 and will accommodate work with maximum heights of 22, 30 and 40 in., respectively. The grinding head carriage on a machine of the smallest size is mounted on V- and flat ways on the bed. Traversing speeds from 12 to 30 ft. per min. are obtainable, and drive is taken from a 4-speed,

reversing, 5-h.p. motor.



This modified version of the Mattison 500 UK travelling head grinding machine, for facing the ends of large coil springs, has two working stations

A segmental grinding wheel of between 30 and 36 in. diameter is employed, and the large-diameter wheel spindle runs in precision-type Timken taper roller bearings. Drive is taken from a 40-h.p. motor, which is mounted above the head, and is transmitted to the spindle through multiple V-belts. Cross-movements of the grinding head can be made by hand or power, drive for the latter motion being taken from a ¼-h.p. motor. In addition, feed increments can be applied either automatically or under hand control, by means of a separate, ¼-h.p. motor.

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Gaston E. Marbaix, Ltd., Devonshire House, Vicarage Crescent, London, S.W.11, are the agents in this country for Mattison Machine Works.

Harrison Horizontal Milling Machine

In the figure is shown the latest addition to the range of milling machines built by T. S. Harrison & Son, Ltd., Union Machine Tool Works, Heckmondwike, Yorks. This machine is arranged for automatic cycle operation, and fast traverse for the table, at the rate of 280 in. per min., is provided by means of the flange-mounted brake-type motor seen at the left. Alternatively, the machine can be supplied without facilities for automatic cycle operation. Longitudinal movement of the table is then provided by a separate power drive,

and there are facilities for hand setting.

The work-table has a surface of 30 by 8 in. and is T-slotted and ground. Longitudinal and transverse movements of 15 and 61/2 in. are obtainable, and the vertical traverse of the knee is 11 in. Transverse and vertical movements are hand operated, but the longitudinal for motion there are eight power feeds, ranging from 0.89 to 12.6 in. per min.

The spindle has a No. 30 international standard nose and there is a choice of eight speeds in two ranges, namely 45 to 1,000 and 67 to 1,500 r.p.m. Drive is taken from a 2-h.p. motor and is normally controlled by direct-on push-buttons.

If required, a multi-disc friction clutch and brake can be incorporated in the drive as additional equipment.

Of cast iron, the column and over-arm are



Harrison horizontal milling machine

secured to a weld-fabricated steel base, and the latter houses the main driving motor, also coolant equipment, if required. A vertical milling attachment is available for use with this machine, and incorporates gearing to provide spindle speeds from 84 to 1,860 or 125 to 2,800 r.p.m., depending on the speed range of the horizontal spindle. This attachment also has a No. 30 standard nose, and is arranged to swivel through 45 deg. on either side of the central position.

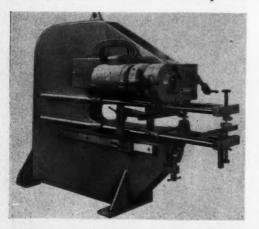
Pioneer Type NA 1200/9 Universal Shearing and Nibbling Machine

The firm of Bachofen & Meier, Bulach, Switzerland, have recently added the type NA 1200/9, here illustrated, to their Pioneer range of universal shearing and nibbling machines. Reference to the smaller type NA 1000 machine was made in

MACHINERY, 94/900-22/4/59.

This new size has a capacity for nibbling and shearing mild-steel sheet up to % in. thick, and for forming, peening, louvring, flanging, and folding sheet up to % in. thick. Drive is taken from a 3-speed motor of 5½/6/8 h.p. which gives speeds of 700/900/1400 r.p.m., and the stroke is steplessly variable from zero to % in. The machine body is of welded steel construction and the nibbling head is a malleable casting. All rotating parts run in ball bearings.

A circle cutting attachment, supplied with the machine as standard equipment, has a capacity from 9½ in. to 110 in. There is also a straight guide cutting attachment which is adjustable vertic-



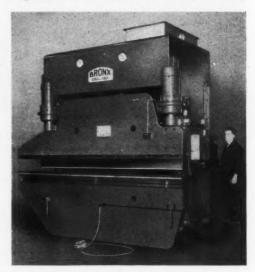
Pioneer type NA 1200/9 universal shearing and nibbling machine

ally and horizontally. The machine will shortly be available with a co-ordinate table.

The sole agents in this country for Pioneer universal shearing and nibbling machines are the Press & Shear Machinery Co., Ltd., 172-178 Victoria Road, Acton, London, W.3.

Bronx Hydraulic Press Brakes

The range of hydraulic press brakes made by the Bronx Engineering Co., Ltd., Lye, near Stourbridge, covers sizes from 120 to 750 tons. In the



Bronx 120-ton hydraulic press brake

accompanying illustration is shown a 120-ton machine which has a capacity of 8 ft. between columns, and 12 ft. overall, a 2-ft. horn extension being provided at the left-hand end of the bed and slide.

It is stated that the hydraulic system enables "air bends" to be made with the same accuracy as is obtainable with a mechanical press. The machine cannot be overloaded, and the rated tonnage is available throughout the whole length of the stroke.

Provision is made for inching down the slide, and reversing it at any point in the stroke. Selector switches enable the machine to be set for continuous or single-stroke operation, with timed dwell, or indefinite dwell at the bottom of the stroke and automatic reversal when a pre-set toninge is reached.

Developments in Explosive Forming*

By W. S. HOLLIS, Ph.D., B.Sc., A.F.R.Ae.S., M.I.Prod.E.†

WITH EXPLOSIVE FORMING, energy resulting from detonation of the charge is transmitted in the form of impulse waves through a suitable medium, usually air or water, with the result that deformation of the workpiece metal takes place under high hydrostatic forces. Since the resulting strain rates considerably those exceed obtainable mechanical means, spring-back of the metal is virtually eliminated. Another effect of the rapid application of the hydrostatic forces is that strain hardening is reduced, and the yield strength of the metal is improved without the introduction of localized, unbalanced, stresses. Deformation of the work is usually completed within 100 milliseconds, of which the elastic phase occupies about 25 milliseconds.

In addition to forming operations on sheet metal parts, explosives may be employed for swaging and for compacting metal powders. For explosive

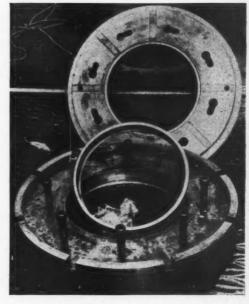


Fig. 2. The flanged conical ring shown resting on the lower half of the mild steel die has a wall thickness of 18 s.w.g., and was explosive formed from a welded blank

forming, single-piece dies are often employed, which, when small batches of parts are to be produced, may be of simple design, and backed up by large masses of shock-sustaining material such as Kirksite or Kayem alloy. Epoxy resins have good

* Abstract of a paper presented at the recent conference on "Modern Trends in the Manipulation of Metals" arranged by the Institution of Production Engineers.
† Assistant Director, Aircraft Production Development, Ministry of

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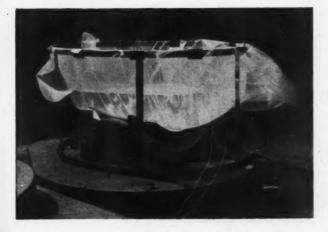


Fig. 1. For producing a panel from a shaped blank prepared from 22 s.w.g. sheet of Nimonic 75, the explosive charge was immersed in water, contained in a polythene bag, which was suspended above a die made from Kirksite. With this arrangement, puckers were formed at one end of the completed workpiece, which, it is considered, could have been avoided by the use of a pre-formed blank, and a different arrangement of the explosive charge

recovery properties, and for this reason, these materials may be used for making dies for certain explosive forming operations. A die for explosive forming a fairly large cylindrical or conical component usually takes the form of a cast matrix of Kirksite or epoxy resin, supported by a ring with a wall thickness of about 8in., which is cast in nodular iron.

In certain instances, pre-forming of the workpiece blank by drawing or other means may be necessary, to reduce the risk of bursting portions which are not supported by the die, when the actual explosive forming operation is being carried out. Blanks for tubular components should be prepared by rolling and seam welding, and should be of such dimensions as to permit explosive forming to the required size and shape without exceeding the permissible strain values. Blanks of heat treatable steel should be fully annealed, and, following explosive forming, hardening, precipitation treatment, and a sizing operation to remove any irregularities in the workpiece shape, may be carried out.

Some work in the field of explosive forming has been undertaken by a number of firms and organizations, including Rolls Royce, Ltd., D. Napier & Son, Ltd., Lucas (Burnley), Imperial Chemical Industries, Ltd., De Havilland, and the Production Engineering Research Association. The College of Aeronautics have undertaken investigations into the parameters introduced by the shape and size of the explosive charge, stand-off distance, and effective hydrostatic head above and below

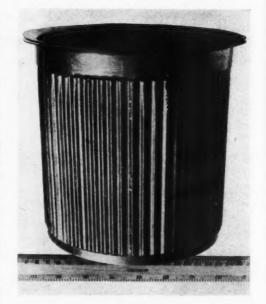


Fig. 5. Explosive forming of this component was carried out in a vacuum, at a single operation, with an 8-ft. length of Cordtex weighing 1.023 oz.

the charge, for explosive forming light alloy, stainless steel, and titanium. In addition, spring-back





Fig. 3. (left) Bearing housing component, made from 14 s.w.g. thick Fortiweld material, is 31 in. diameter at the neck, and was produced by explosive forming in three operations. For the first operation a 12 ft. long Cordtex explosive charge was used, which weighed 38·1 grammes (1·34 oz.). Cordtex charges 20 ft. long, which weighed 63·5 grammes (2·4 oz.), were employed for the second and third forming operations

Fig. 4. (right) Bearing housing component, of 24 in. diameter, which was formed at two operations. A 12-ft. long Cordtex charge, weighing 1:34 oz., was employed for the first forming stage, and an 8-ft. length (1:023 oz.) for the second operation

of the workpiece metal, and bend radii, have been investigated. Apart from providing information on construction of equipment and safety precautions, A.R.D.E., Fort Halstead, have been concerned with the forming of hemi-spherical and tubular shapes with the object of studying certain variables, and have approached the subject as a fundamental study in physical metallurgy. It is expected that explosive forming will be established as an industrial process at one of the Royal Ordnance Factories.

Work has so far been carried out with charges of Cordtex (Imperial Chemical Industries, Ltd.) explosive, with weights ranging from 10 to 70 grammes (0.35 to 2.46 oz.), for forming various components for aircraft from different sheet metals.

Cordtex is somewhat similar in appearance to domestic electric cable, and is available in lengths of 500 ft., each of which provides an explosive charge weighing 3½ lb. Although Cordtex is chemically stable, certain safety precautions should be observed when it is being handled. It can be cut to the required length and is fired by a detonator, connected by electric cable to an exploder, which usually takes the form of a generator of the hand winding type. It may be mentioned that investigations are proceeding at A.R.D.E., in connection with the explosive forming of workpieces with charges which weigh as much as 4 lb. Some setups for explosive forming, and examples of workpieces that have been produced by this process, are shown in Fig. 1-5.

Hopper Feed for Taper Pipe Plug Blanks

In the accompanying figure is shown a vibratory-type spiral track hopper which is employed for feeding taper pipe plug blanks to a Landis Lanhyrol thread-rolling machine (Landis Machine Maiden, Ltd.). The blanks, which have square sockets, are tapered externally, and must be fed to the threading rolls correctly orientated. It will be noted that the blanks are loaded at random into the hopper, and proceed along the spiral track in a clock-wise direction towards the deflector plate A.

This plate serves to turn the blanks through 90 deg., so that they proceed on their sides, but it will be appreciated that they are still arranged at random as regards the external taper. Between the end of the deflector plate A and the entry end of the delivery chute from the hopper there is a gap, and immediately above this gap is mounted a proximity-sensing device B. This device is located transversely so that it is in line with one end of each blank, and depending on the orientation of the latter, the periphery will be close to, or removed from, the sensing probe, as a result of the taper.

For correct orientation, the blanks must enter the delivery chute with the socket portions away from the camera. It will be noted that the blank at the right-hand end of the deflector plate A is incorrectly orientated, and when it advances to a position beneath the probe the latter will operate to close an electrical circuit. As a result, a pneumatic cylinder is energized to

advance a small plunger, the leading end of which is indicated at C, and the incorrectly-orientated blank is thrust sideways from the track and falls into the hopper.

On the Lanhyrol machine which is fed by the hopper, one blank is threaded for each revolution of the rolls, and the production rate for ½- and ¾-in. pipe plugs is stated to be 132 per min., and for 1-in. plugs, 100 per min. The Lanhyrol machine was described in Machinery, 97/615—14/9/60.



This spiral-track vibratory-type hopper is used to deliver tapered blanks for pipe plugs to a Landis Lanhyrol threadrolling machine. It incorporates a proximity-sensing device which rejects blanks that are incorrectly orientated

Hayes Tracemaster 3-spindle Copy Milling Machine for Cylinder Heads

The Tracemaster 3-spindle machine shown in Fig. 1 has recently been supplied by Hayes (Engineers), Ltd., Gelderd Road, Leeds, 12, to the Standard Motor Co., Ltd., Coventry, for copy milling compression cavities in heads for 6-cylinder engines. It has been developed from the Tracemaster type TM. 43-3D machine which was described in Machinear, 94/41—7/1/59, and is equipped with a special cutter head.

The profile shape of the compression cavity is controlled by a template, surmounted by a guide plate. This template is secured to the left-hand end of the work-holding fixture, which is mounted on the table, as may be seen in the close-up view Fig. 2. When a cylinder head has been loaded into the fixture, a push-button is pressed to start the working cycle. The table knee is then raised hydraulically, with the result that the work is fed upwards in relation to the cutters to bring it into

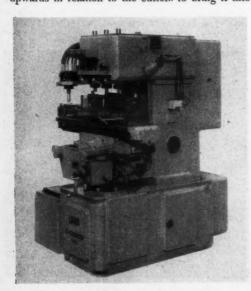


Fig. 1. This Hayes Tracemaster type TM. 43-3D machine is equipped with a 3-spindle cutter head and was supplied for copy milling compression cavities in cylinder heads



Fig. 2. Close-up view of the work and template on the machine shown in Fig. 1

position for milling the cavities to the full depth, and the template is brought to the working position. Next, the stylus pin of the Digitrace 360-deg. hydraulic tracer head is guided by hand round one of a pair of openings in the template, for copy milling three of the cavities in the cylinder head.

When these cavities have been completed, the knee is automatically lowered to bring the face of the cylinder head clear of the cutters. The stylus pin is now moved sideways, through the central opening in the guide plate, and the three remaining cavities in the cylinder head are thus brought into position beneath the cutters. When the knee is automatically raised to its original position, the pin is traversed round the second template opening to complete the operation.

Finally, another push-button is operated, with the result that the knee is lowered again to bring the top face of the work clear of the cutters, and the spindles are stopped in readiness for unloading the cylinder head. When the knee has been brought to the unloading position, the tapered end of the stylus pin is still within the opening in the guide plate. It is thus ensured that during the subsequent upward movement of the knee, the stylus is guided into a template opening.

Mattison-Anocut Electrolytic "Grinding" Machine

AT THE WORKS OF THE INGERSOLL MILLING MACHINE Co., Rockford, Illinois, U.S.A., tungstencarbide tipped blades for milling cutters are being "ground" electrolytically, and it is reported that considerable economies are thus obtained. This operation is carried out, after the carbide tips have been brazed to the blades, on a No. 24 A vertical-spindle, rotary-table, surface grinder, built by the Mattison Machine Works, Rockford, which is provided with 1,500-amp. electrolytic "grinding" equipment, supplied by the Anocut Engineering Co., Chicago, as shown in the illustration.

The work table on this machine is driven at an exceptionally low speed, in the range from 1.7 to 12 rev. per hour, and from 0.005 to 0.008 in. of metal is removed from the top face of the carbide tip and the blade at a single pass beneath the 16-in. diameter diamond-impregnated grinding wheel, which has a face width of 4 in. Surface finish on the work is held within 20 micro-inches. Because about 90 per cent of the metal is removed from the work by electrolytic action, only a very small amount of wheel

small amount of wheel wear takes place, and it is stated that expenditure on grinding wheels has been reduced by 80 per cent. In addition, heating—and consequent cracking—of the carbide tips is avoided. With the grinding wheel employed, diamond particles of 100 grit extend for a depth of the in. into the face. Drive to the spindle is taken from a 25-h.p. motor, which runs at a speed of 1,800

Previously, grinding was carried out on a conventional horizontal-spindle machine, but since a considerable pressure was required to remove metal from the carbide tip, some gouging of the steel blade took place, which resulted in clogging of the grinding wheel. In con-

sequence, there was a risk of spoiling the workpieces, due to heating and cracking of the tips.

Milling cutter blades are loaded on to-and subsequently removed from-the magnetic chuck on the table of the Mattison machine, by hand. Wedge-shaped magnetic pole pieces in the chuck are automatically energized individually when the blades have been brought close to the wheel, and are de-energized as soon as "grinding" has been completed. Electrolyte is blown outwards away from the brushes which carry current to the grinding wheel by compressed air delivered by a small blower unit, and there is a collecting system for returning the vapour, by way of a condenser, to the reservoir. A limit switch is operated to stop the table in the event of an oversize cutter blade being fed to the grinding wheel. When a pre-set load is applied to the Anocut unit, a brake is automatically applied to stop the table. If required, automatic work sizing equipment can be provided.

Gaston E. Marbaix, Ltd., Devonshire House, Vicarage Crescent, London, S.W.11, are the agents in this country for Mattison Machine Works.



This Mattison vertical-spindle machine, provided with Anocut equipment, has been installed in the works of Ingersoll Milling Machine Co., for the electrolytic "grinding" of tungsten-carbide tipped blades for milling cutters

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Cross Transfer Machine for Small Cylinder Blocks

A COMPLEX IN-LINE TRANSFER MACHINE has recently been supplied by the Cross Company, Detroit, Michigan, U.S.A., to a well-known motor car manufacturer in Europe for operations on 4-cylinder blocks for a small car, and a general view of part of this machine is shown in Fig. 1. It provides for milling, cylinder boring, drilling, reaming, tapping, machining cam- and crankshaft bores, assembly of bearing caps, and inter-stage and final inspection. A total of 123 holes of different sizes will be machined, and several faces milled, and the output will be approximately 85 blocks per hour. Cycle times for certain sections of the installation differ, and to ensure balanced

flow, storage conveyors are provided at various points. The layout of the machine is such that it can be adapted to accommodate alterations to the design of the blocks, as required.

The machine is divided into six main sections, and the view in Fig. 1 shows the first four, with section No. 1 in the foreground. Blocks are delivered to the machine with the top and bottom surfaces already machined, by broaching, and in the first section a number of heavy metal-removal operations are performed. Before passing to the machining stations in this section, the blocks are automatically rolled through 270 deg., to ensure that any chips remaining from the broaching

operation are discharged, and are then automatically positioned and

clamped.

Each block casting is checked by means of a battery of probes, which are automatically advanced to enter various portions, and some of these units can be seen in Fig. 2, where the outline of a block is shown superimposed in white. If any probe is unable to enter the block, on account of interference with a cast surface, a signal is transmitted by an airoperated device, and the faulty casting is removed.

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In the first section of the machine, the operations performed include straddle-milling the crankshaft bearings, cutting anchor-lock notches and oil-slinger grooves, and drilling tappet holes. Between these operations, the block is again rolled, to discharge chips, and the next station provides for boring the cylinders. A view of this portion of the machine is shown in Fig. 3, and it will be noted that there are two vertically-mounted, twin-spindle boring heads. These heads are carried on massive cast-iron columns-each of which weighs 7 tons-bolted to the main bed of the machine. Alternate cylinder bores are machined by each head, and the blocks are indexed from one head to the other to complete the four bores.

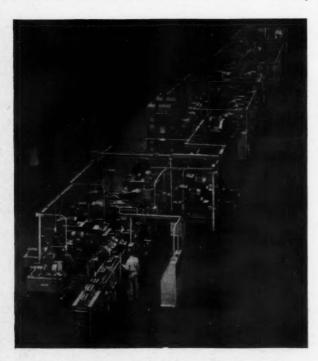
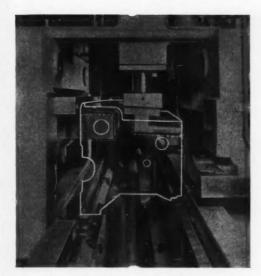


Fig. 1. General view of part of a large in-line Cross transfer machine which has been supplied to a well-known Europeanmotor car manufacturer for performing multiple operations on 4-cylinder blocks



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Fig. 2. In this close-up view can be seen the probe units which are advanced at the first station to check the block prior to clamping. The outline of the block is shown superimposed in white

It may be noted that the boring spindles are of the cartridge type and are provided with water-cooling, to ensure an even operating temperature. Attention may also be drawn to the fact that each column has a deep throat, to house the major portion of the boring head. With this arrangement, the vertical guides are located in the same plane as the spindle axes. As a result, bending forces imposed by the boring operation are reduced to a minimum, and accurate control of the path of the Throughout the cutter is ensured. first section of the machine, the blocks are indexed in 36-in. increments by conventional axially-sliding bar arrangement, a part of which can be seen in the foreground of Fig. 2. This bar is provided with projecting ears, and is turned about its longitudinal axis, to engage and disengage the ears with the castings at the beginning and end of each transfer stroke.

On entering the second section of the machine, which provides for milling the end faces of the blocks, the latter are turned through 90 deg., and proceed with their longitudinal centre lines at right angles to the direction of transfer. In this section, the transfer increment is 24 in., and movement is imparted to the blocks by a walking-beam mechanism.

Motion for the latter is derived from the cylinders which provide for the feed of the milling heads, and the direction of feed is opposite to the direction of transfer. The arrangement is such that when the milling heads are returned to the starting positions the transfer movement takes place simultaneously, and since both these movements are in the same direction there is no relative motion between the work and the cutters. Consequently, the need to provide for cutter relief is avoided.

A view of the milling heads provided in the second section of the machine is given in Fig. 4, where cylinder blocks can also be seen. The pair of milling heads in the foreground is duplicated at the other side of the machine, and the right-hand head at each side provides for rough-machining and the left-hand head for finish-machining. At the completion of any one feed stroke of the heads, both ends of one block have been rough-milled, there are two rough milled blocks at idle stations between the two heads, and

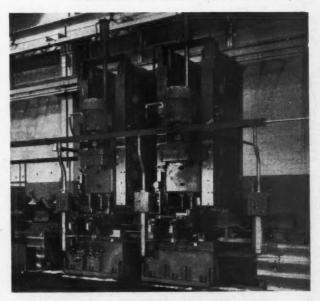


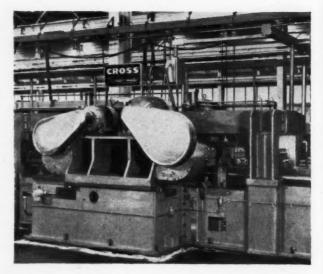
Fig. 3. General view of the cylinder-boring section. Two twinspindle vertical heads machine alternate bores, the blocks being indexed between operations

Fig. 4. In this general view of the milling section can be seen two of the heads which provide for rough and finish machining the end faces of the blocks. There is a corresponding pair of heads on the opposite side of the machine.

both ends of one block have been finish-milled. When the blocks leave this station all the heavy-metalremoving operations have been completed, and there is ample time during the subsequent light-machining operations for the temperature of the castings to become stabilized, in readiness for the finishing operations at the end of the sequence.

The second section of the machine also provides for deep-drilling oil gallery holes and for checking the

porosity of the casting. Drilling is carried out, to progressively increasing depths, at six different stations, and at each station a Cross Protect-O-Tool unit monitors the operation and automatically shuts down the section if a drill should break. After it has been drilled, each gallery hole is plugged and air is introduced, under pressure, for a predetermined period. If there is a leakage of air during this period, the block is sprayed with yellow paint and removed from the machine, to



ensure that no further operations are performed.

Blocks leaving the last station of section 2 are turned through 90 deg., in the horizontal plane, and are fed to a storage conveyor, whence they are later delivered to the third section of the machine. This section provides for a number of conventional light-duty milling and drilling operations, on both sides of the blocks, also for tapping, rough-reaming the tappet holes, and chamfering both ends of the cylinder bores. The blocks now

enter section four, which serves only for semi-finish and finish reaming the tappet holes. There are eight idle stations between these two operations, and finish reaming is performed by heads which are effectively isolated from the main machining line. A filtered coolant system is provided, and serves this section of the machine only.

From section 4, the blocks are passed to a washing unit and thence to a storage conveyor, and are sub-

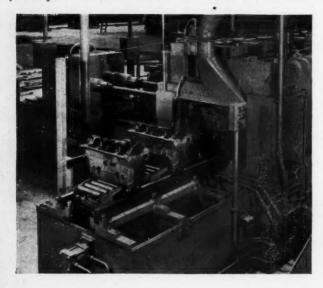


Fig. 5. The final section of the machine provides for rough and finish machining the cam- and crankshaft holes in two blocks at a time. In the left background can be seen one of the 4-spindle heads provided 'for these operations

sequently delivered to section 5, where the four crankshatt main bearing caps are assembled. An operator places the caps in position, also inserts two bolts in each, and the latter are then automatically tightened, to a pre-set torque, at the single working station provided in this section. The blocks are then diverted to another storage section, whence they are automatically delivered, two at a time, to the first station of section 6, the entry end of which is shown in the close-up view Fig. 5.

Here, both the camshaft and crankshaft bores are rough-machined in two blocks simultaneously, a typical 4-spindle head being seen in the left background. The free ends of the boring bars are guided in live bushes, carried in the column at the right, and intermediate support is also provided by bearings located within the cylinder blocks.

At the third station of this section, the thrust faces on the bearing caps are faced, and oil-slinger and seal grooves are machined. Finally, a further operation is performed on the cam- and crankshaft bores and the blocks are delivered to a cleaning section, which is equipped with special brushes and air-blast nozzles. Finished blocks are then delivered to a checking station, where all the bores are inspected automatically, with airgauging equipment.

Large Triulzi Injection Moulding Machine

Built by Triulzi, Milan, the injection moulding machine here shown has a clamping force of 2,500 (short) tons, and an injection capacity of 425 oz. It is stated that the first three machines of this size have been ordered by a German company for the production of inner casings for refrigerators. For these items the output is 30 per hour, and the machine is suitable for producing other large mouldings for domestic applications.

The machine is designed to operate on an automatic cycle, but the various movements can be controlled separately, when required, by pushbuttons. A maximum injection force of 220 tons can be applied, which, with a standard injection

plunger, corresponds to an injection pressure of 22,000 lb. per sq. in. With this pressure, and the high injection speeds obtainable, it is claimed that thin-walled mouldings can be produced from any thermo-plastic material.

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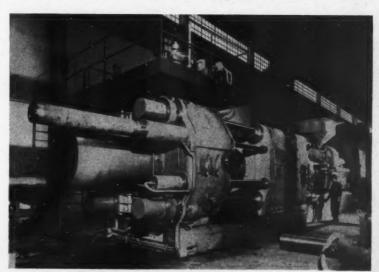
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nce ubOf cast steel, the main frame members are

carried on a bed-plate made from rolled steel sections, and the rams and tie bar are ground and hard chromium plated.

Hydraulic equipment, including the valves and servo controls, is mounted on a platform above the reaction head. The electrical equipment is installed separate from the machine so that it is unaffected by vibration, and the control gear is enclosed in a sealed housing which provides protection, against the ingress of dust and temperature variations.

Triulzi moulding machines are handled in this country and the Commonwealth by Baker Perkins Granbull, Ltd., Kingston-on-Thames.



This Triulzi moulding machine, which will be employed for the production of refrigerator casings, has a capacity of 425 oz.

Fillet-rolling Operations on Dieselengine Crankshafts

By W. EGGER

AT THE FORD TRACTOR and Implements Division Works, Highland Park, Mich., U.S.A., a single line of machine tools produces two different crankshafts for diesel- and petrol-engine tractors. The use of a dual-purpose line is unusual in that the diesel crankshafts are machined from 4145 steel forgings, heat-treated to 285-321 Brinell, whereas the petrol-engine crankshafts are shell-moulded nondular-iron castings. Both types, however, have practically the same dimensions. The shafts are 25.75 in. long, with four 2.3-in. diameter crank pins and three 2.5-in. diameter main journals. Throws are identical, since each engine has a displacement of 172 cu. in.

The first 16 machining and grinding operations

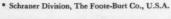
on both crankshafts are similar. Subsequently, the petrol-engine crankshafts are finished on a Schraner lapping machine, washed, and oiled, in readiness for assembly.

Diesel-engine crankshafts, on the other hand, are first demagnetized, and then washed to remove chips. After the oil holes have been plugged, all crankpin and main journal fillets are rolled on the Schraner fillet-rolling machine seen in Fig. 1. Next, the crankpin and main journals are burnished to 10 to 12 micro-inches. After being again washed, the crankshafts are coated with an anti-rust compound.

Following the lapping or rolling operation, finish is checked with a Profilometer, and visual inspection is carried out to ascertain whether the fillet radius is correctly blended with the journal.

Occasionally, crankshafts are tested to destruction to determine the hardness values of the fillets, journals, and core, also to check the tensile and fatigue properties.

Preliminary investigations showed that roll burnishing would produce a high-quality finish on the journals, and that fatigue strength could be further increased by rolling the fillets. Ford engineers at first attempted to combine roll burnishing and rolling in a single operation on a master-crank type of machine. It was quickly ascertained, however, that normal tolerance variations in journal width and in fillet accuracy precluded simultaneous Despite the high hydraulic pressure (450 lb. per sq. in.) employed, it



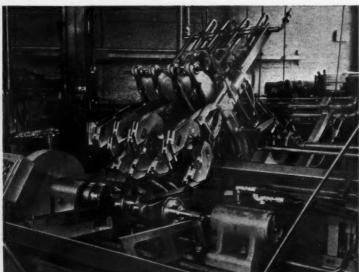
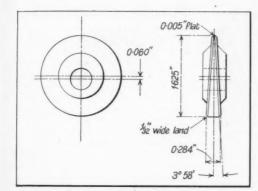


Fig. 1. The fillet-rolling machine with a crankshaft in position. Crank throws match the head settings but the hydraulic tailstock has not yet been advanced. After the roller shoes have closed on the crankpin and main journal fillets, the clamping arms are released, leaving the heads free to reciprocate with the throws as the shaft rotates



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Fig. 2. Dimensions of the wedge-shaped fillet rollers employed. These rollers are of oil-hardening tool steel, heat-treated to 62 to 65 Rockwell C

was barely adequate to burnish the fillets and journals, and insufficient to compression-roll them to obtain added fatigue strength.

Tests have shown that as a result of rolling, fillets are pre-stressed in compression, with the result that tensile and impact forces in service are counteracted. The fillet rolling action does not need to be very deep. It is only necessary to deform, plastically, surface layers of the metal and work-harden the fillet to a depth of 0.0001 to 0.0005 in. The rolling increases hardness from 34 to as much as 55 Rockwell C (as converted from the superficial hardness scale). In addition, the kneading action of the rollers improves surface finish, from 30 to 12 micro-inches or less.

To deform metal plastically, high compressive force is required. With the Schraner equipment, however, the desired result is achieved by applying relatively low force hydraulically to an

eccentric, wedge-shaped roller having a small contact area, as indicated in Fig. 2. As the roller rotates on its pin, following the fillet, the narrow portion of the wedge rolls metal at the centre, as seen at A in Fig. 3. Rotation away from the wedge point works the fillet metal towards the extremities, as at B and C. Beyond the wide zone, the wedge shape works the fillet metal towards the centre.

Thus, as the shaft and roller rotate in contact, narrow lands on the roller circumference ride up and down on each side of the fillet with a "kneading" action. Only a few cycles are necessary to roll the entire fillet thoroughly and the floor-to-floor time is 26 sec. per cranksnatt. Fig. 4, which is a close-up view of the tooling, shows how the rollers are mounted in the shoes.

The contact area of each roller is about 0.00027 sq. in., so that an applied force of only 175 lb. produces a compressive shear stress of 650,000 lb. per sq. in. to cause metal flow. A light oil lubricant prevents galling at this high pressure, and helps to

ensure a good finish.

To permit uniform roller contact over the entire fillet surface, the preparatory grinding of the fillet must give a form which is circular within close limits. Although circularity of the fillet is at present held to ± 0.0025 in. (half the specified drawing tolerance), an automatic wheel dressing operation is planned which will enable a radius of 0.120 to be maintained within ± 0.001 in. Journal-width tolerance, however, may be as much as 0.015 in., since the free-floating action of the rollers compensates for such variation.

LOADING THE SHAFT AND PERFORMING THE FILLET-ROLLING OPERATION

To roll the fillets, the operator roughly positions one end of the crankshaft in the headstock of the machine, while the other end rests on a rail, as may be seen in Fig. 1. By means of a mark on the spindle, he aligns the throws with seven prepositioned heads. Each head has a pair of arms which carry the roller shoes. The cycle is started by pressing a button and a carriage is then lowered to locate the shoes on their respective crankpins and main journals. Meanwhile, the tailstock is moved in to centre the shaft, and engage it

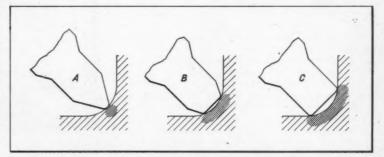


Fig. 3. The wedge-shaped roller is mounted eccentrically in its shoe, and the area of contact with the fillet changes continuously during rotation



Fig. 4. Four rollers are mounted in each pair of opposed roller shoes, which close on each crankshaft journal and crankpin. The rollers are free to shift laterally by 0.015 in., to compensate for variations in journal width. They are diametrically opposed in the two fillets when the shoes are closed

with a locating pin in the driving spindle. When nylon bumpers in the throat of each head strike the journals, the shoes are closed and locked through a scissors linkage. This action pre-sets each roller to exert a force of 175 lb. Next, the arm clamps are released, and the crankshaft is ready for fillet rolling.

A second button is then pressed to start crank rotation at 150 r.p.m. The heads are free to reciprocate vertically, following the throws of the crankshaft as it rotates. After 11 revolutions, rotation is stopped automatically. Operation of a third button reclamps the arms in place to receive the next crankshaft, opens the roller shoes, withdraws the tailstock, and raises the carriage in readiness for the next cycle. Movements of the tailstock, carriage, arm clamps, and shoes are effected hydraulically.

When the shoes close, jets of a lardbase oil, from a row of nozzles mounted in the machine table, are directed upwards to lubricate the fillets and rollers. The flow is shut off when the shoes re-open.

If the workpiece is incorrectly positioned, the operator can safely raise the carriage to seat it properly. Moreover, the relatively low hydraulic pressures employed ensure that the rollers, shoes, and slides are not damaged in such circumstances.

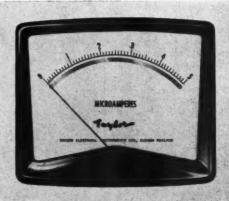
Occasional replacement of the wedge rollers is the only maintenance necessary. Ford have experimentally processed as many as 15,000 crankshafts with one set of rollers, but in production, rollers are reground after every 1,000 shafts.

New Vista Panel-type Meters

Taylor Electrical Instruments, Ltd., Montrose Avenue, Slough, Bucks., have recently introduced a new range of panel-type meters, a typical example of which is shown in the accompanying figure. The escutcheon moulding has been designed to provide an "open-face" dial which is shadow-less. Four versions are available, with scale lengths ranging from 1% to 4½ in. and d.c. sensitivities from 5 micro-amps. The range also includes moving-coil a.c. and d.c. types with rectifiers, thermo-couples from 10 mA. to 5 amp., moving-iron versions from 10 mA. to 50 amp., and voltmeters from 10 amp.

Mirror scales and special scales to customers' requirements can be supplied, also knife-edge or spade-type pointers. The bases of all instruments in the range are designed so that the meters are interchangeable with standard meters of earlier designs.

A typical example from the new range of Vista panel-type micro-ammeters which has been introduced by Taylor Electrical Instruments, Ltd.



NEWS OF THE INDUSTRY

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Henry Milnes, Ltd., Ingleby Works, Rosse Street, inform us that the demand for their standard milling machines and centre lathes is well maintained, and that orders are being received for standard and special fine boring machines from both the home and export markets. In this connection it may be noted that one of these machines now under construction is destined for Brazil.

The standard heavy-duty fine borer, which has a 20-in. head traverse, a 30-in. table traverse, and a 15-in. vertical traverse, can now be supplied with the Ferranti co-ordinate positioning system, Hilger & Watts optical measuring equipment, and Microbore tooling.

New equipment at present being developed includes a square indexing table for the fine boring machine, provided with a push-button controlled locking device, and a push-button operated drawbar for the spindle. We hope to describe both these items at a later date.

HINDLE AUTO PRODUCTS, LTD., Caledonia Street, are extremely busy with the production of shaved and hardened and ground gears, splined shafts, and gearbox units. We are informed that the production of standard and special gearboxes now accounts for 40 per cent of the output. This company is also experiencing a heavy call on their services, from various sections of the engineering industry, for gear cutting from customers' blanks, including shaving and grinding, splining, broaching, and heat treatment, and it may be noted that a 7- to 10-day service is provided by the contract spline-cutting and broaching departments.

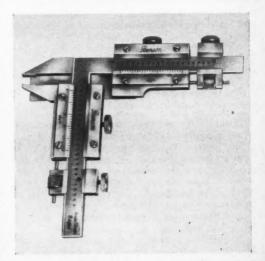
To overcome the effects of a shortage of skilled labour this company has recently carried out a re-equipment programme in the works, and machines installed have included a Churchill Redman P.5 hydraulic profiling lathe, a Ward No. 7 combination turret lathe, a Parkson Gearburr de-burring machine, and a Henry Milnes heavy duty fine borer with Hilger & Watts optical measuring equipment. We are informed that the results of this policy have so far been quite satisfactory, and that during the past year an increase in production of 20 per cent per man-hour has been obtained.

Benson Verniers, Ltd., Carlton Street, whose products include vernier gauges of all types, calipers, steel beam trammels, and die makers squares, have experienced a good demand for all their products during the past year.

The gear tooth vernier, as shown in the accompanying illustration, has recently been re-designed, and is now of the solid beam form, and is fitted with a type "B" vernier scale to B.S. 887:1950.

In recent months there has been an increase in the volume of orders for the triangular beam vernier height gauge. In addition, increasing calls have been made on the company's services as suppliers of machine tool dials and graduated scales with hard chromium finish.

A machine shop extension of some 3,250 sq. ft. has recently been completed, and new equipment installed includes a Churchill grinding machine with a 42-in. long by 12-in. wide table. A number of milling machines and grinding machines is at present on order for this section, including a Jones & Shipman 540 grinding machine and a Parkson



The latest Benson solid beam gear tooth vernier is provided with a type "B" vernier scale to B.S. 887:1950

No. 2.V. vertical miller. Work has now begun on a further extension to which we hope to make reference at a later date.

Crofts (Engineers), Ltd., Thornbury, are fully occupied with the manufacture of a wide range of products including couplings, Radiation gear reduction units, V-belt drive units, and Ritespeed motorized conveyor pulley units. The contract gear cutting department and the ferrous and nonferrous foundries are reported to be working to capacity. We were informed, however, that there has been a slight falling-off in the volume of orders for clutches and universal-mounting worm reduction units, during the past few months.

T. Bowers & Co., Ltd., Thornbury Street, are experiencing a heavy demand for jigs, fixtures, gauges, press tools and special tooling, and are maintaining a steady production of small tools in the standard range. Orders from Norway and Sweden are at present in hand for the recently introduced internal micrometer, and it is stated that many enquiries for this instrument have been received from various countries in the Near and Far East and in North and South America.

N. Jowett & Co., Ltd., Littlemoor Works, Queensbury, are busy with the production of their thread milling and gear hobbing machine. A long-bed thread milling machine was recently despatched from the works, and a similar machine, with a capacity for milling and splining work up to 55 in. long, is at present in production, together with a number of standard machines of 7%-in. diameter by 28-in. length capacity.

We are informed that an increase in the number of enquiries for this machine has recently been noted, particularly from export markets. Other activities of this company include precision machining, on a contract basis, of a wide variety of component parts for several branches of industry.

STANHOPE ENGINEERS, LTD., 92 Harris Street, report a continued request for their range of gear pump units. We are informed that there has been an improvement in the volume of orders and enquiries from overseas, and that pumps have recently been despatched to India and South Africa. An increase in the demand for fuel-oil transfer pumps has also been experienced, and a steady volume of contract machining work is being handled.

In addition, the company builds special machinery to the designs and specifications of various customers.

MOORE MANUFACTURING Co., LTD., Blanche Street, are busy with the production of their range

of engineers' small tools which includes milling cutters, milling machine arbors and adapters, lathe centres, drill sleeves and sockets, end mills, and reamers. We are informed that a certain amount of re-equipment is at present being carried out, and that recently installed machines have included a Praehoma double table type surface grinder and three Cincinnati milling machines. In addition, two Parkson type 2N milling machines are to be provided in the near future.

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London and the South

SETON CREAGHE ENGINEERING Co., LTD., Park Royal Road, N.W.10, have developed a compact push-button switch which has many applications in the electronics industry. Switching arrangements may be varied to suit different circuit requirements, and provision can be made for illumination of pushbuttons either before or after operation. number of buttons from two to 16 may be provided in a bank, and they may be interlocked mechanically or electrically. The latching and release mechanism, it is stated, is designed to provide for reliable operation over extended periods, and it is so arranged that not more than one push-button at one time, in each bank, can be pressed into the locked position. This type of switch is finding increasing application for controlling electrical circuits in production lines.

Another product of the company is the Secray cleaning unit, which is intended for removing soil from precision ball bearings, jewelled bearings, and instrument components, for example. The parts are enclosed in the unit and heated by hot air issuing from a jet. Next they are sprayed with a cleaning solvent, and are finally dried, by a further application of hot air, prior to being enclosed, while still warm, in polythene bags, which are afterwards sealed.

Watson Manasty & Co., Ltd., Orleans House, Manor Road, Teddington, Middlesex, report a continued demand for their Shadomaster range of optical projectors from the home and overseas markets. This range includes the VMP vertical measuring projector which is intended for use in tool-rooms and metrology departments; the type CRP Mk. 2 vertical projector, which may be employed for repetition optical gauging and direct measurement; and the Junior, Minor, and Magnum projectors for bench or wall mounting. A steady call is reported for Shadomaster translucent machine-ruled charts which are prepared from master layouts produced on a 30-in, by 23-in. co-

ordinate ruling machine, designed and constructed by the company and installed in a temperaturecontrolled room. Facilities are available for the production of special charts and component fixtures for use with Shadomaster and other projectors.

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HIGH SPEED SERVICE TOOL Co., LTD., 86 Maple Road, Surbiton, Surrey, have a wide variety of medium-sized and small press tools in progress for firms in many parts of Britain, also for customers in the U.S.A. Many press tools are supplied by the company for the production of parts of complicated shape for typewriters, calculating machines, and electrical equipment. Machining operations required on components for a large proportion of the press tools include the profile-grinding of mating and interlocking surfaces, for which purpose Jones & Shipman type 540 grinding machines, fitted with Optidress wheel forming attachments by Precision Grinding Ltd., are largely employed.

The jig boring section is equipped with a number of modern machines, including one by Hauser. In the main shop an 8-in. stroke Butler slotting machine has recently been installed, also a GKN type B2 spark-erosion machine. Delivery of a 100-ton press is awaited, which is to be employed chiefly for trying-out press tools. The plough grinding service which this firm has operated for many years is in steady demand by regular customers in the locality and in distant areas, and urgent work is frequently undertaken.

F. W. HERRIDGE.

Dispenser for Lapping Compound

With the Hyplicator dispenser recently introduced by Engis, Ltd., Gabriel's Hill, Maidstone, Kent, Hyprez diamond lapping compound made by the company, can be applied to workpieces in accurately-controlled amounts, so that waste is avoided. Shown in the illustration, the dispenser will take a quantity of compound weighing 5 gm.

For dispensing compound through the small-diameter nozzle, a neoprene plunger is advanced within the body by rotating a knurled, internallythreaded ring which engages with a screw. In this way, the movement of the plunger, and consequently the amount of compound which is passed through the nozzle, can be accurately controlled. The body, nozzle, screw, and adjusting ring are made from nylon, and since there are no metal parts in the dispenser, the risk of contamination of the compound is avoided. The partlyspherical end of the plunger has a radius slightly greater than that in the nozzle, and with this arrangement, all the compound can be discharged from the body. The nozzle may then be removed from the body, and fitted to another freshly-loaded dispenser if required, so that none of the compound within the nozzle bore need be wasted.

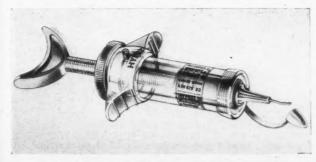
For finishing operations on parts made from certain metals, such as beryllium, which produce a toxic dust, the work is usually enclosed in a cabinet, fitted with glove attachments to take the operator's hands. When such work is being undertaken, the dispenser may be housed in the cabinet with the work, and the knurled ring can then be rotated, for discharging compound through the nozzle, by a friction disc driven by a remotely-controlled motor.

Hyprez lapping compounds are available with diamond particles in 12 different sizes from 0·1 to 90 micron (0·000004 to 0·0036 in.). The particles are suspended in paste which is supplied in different colours to facilitate identification of the various grades of compound.

N.R.D.C. Report

In the eleventh annual report of the National Research Development Corporation, some information is given concerning individual projects on which work was in progress or was started during the period July, 1959, to June, 1960.

Attention is drawn in the report to the Atlas computer project which was initiated last year and is based on techniques for very high-speed comcircuits that have developed at Manchester University. The computer is designed for processing large amounts of scientific and commercial data at extremely high speeds. Building of the prototype is well advanced. The development of the Emidec 2400 computer for commercial data processing has been almost completed and the first machines are due for delivery this



Hyplicator dispenser for Hyprez diamond lapping compound

year. Recently, the Corporation has set up a small study team to consider the possible applications of computers in the shipbuilding industry. The work of the study team is being carried out with the assistance of the Department of Scientific and Industrial Research and is expected to occupy a

period of about six months.

Development work continues on the improved rolling mill incorporating hydrostatic bearings, which is the result of a proposal by Prof. H. Ford and Dr. A. Cameron, Imperial College of Science and Technology. A study of bearing characteristics has enabled parts to be designed for experimental evaluation on a 4-in. two-high mill at the College.

Reference is made in the report to experimental work on the direct generation of electricity by a thermionic method. This project was proposed by Prof. D. Gabor, Imperial College of Science and Technology, and promising results have already

been obtained.

A short programme of development in connection with the Perry steplessly-variable speed gear has been sponsored by the Corporation and patent rights for certain design features in countries outside the British Commonwealth may be sought, with a view to granting licences for these inventions in the countries in question.

The Clerk regenerative mechanical transmission system is in an advanced stage of development and it is reported that trials of a prototype transmission in a vehicle are planned in the very near future.

The report is available from H.M. Stationery Office (price 1s. 3d.).

New Works for Payne Products

Payne Products International, Ltd.—a subsidiary of the Crane Packing Co., Morton Grove, Illinois, U.S.A.—have recently occupied new works, with a floor space of 10,000 sq. ft., at Buckingham Avenue, Trading Estate, Slough, Bucks., which were formally opened by Sir Leslie H. Robinson, K.B.E., Board of Trade.

Formed in 1954, the company handles the sales in the United Kingdom and Europe of the flat lapping machines in the Lapmaster range developed by the parent firm. Lapmaster machines with lap diameters of 12, 24, 36, and 48 in. are built in this country for Payne Products International, Ltd., and 72- and 84-in. machines in the range, for handling components up to 27% and 33 in. diameter, can be supplied by the Crane Packing Co.,

As has previously been described in MACHINERY, parts to be lapped on Lapmaster machines are accommodated within the bores of conditioning rings, which rotate in contact with the top surface



This photograph, taken on the occasion of the opening of the new factory of Payne Products International Ltd., shows (left to right) The Mayor of Slough (Mrs. E. Scott-Picton), Mr. L. P. Hulin, managing director, and Sir Leslie H. Robinson

of the lap while the operation is in progress, and pressure is applied by means of weights. The conditioning rings can be adjusted towards and away from the centre line, and serve to maintain the working surface of the lap accurately flat. With this arrangement, workpieces can be held to within one light band (0·0000116 in.) for flatness, and surface finishes down to 2 to 3 micro-inches, r.m.s., can be obtained when lapping is being carried out on a production basis.

Although Lapmaster machines are usually employed for lapping flat surfaces, one machine has recently been supplied with a special fixture for lapping spherical components. On another machine, the top surface of the lap was machined to a convex shape of 80 in. radius for lapping a concave land on a ring-shaped part. For this operation, the pressure plates are held in contact with the work at an angle to the lap centre line.

Precision lapping of components for customer firms will continue to be carried out on a contract basis at the new works, and an air-conditioned room is provided for the production of optical flats on Lapmaster machines. It may be mentioned that a special interferometer, developed by

Sheffield University, has been installed for checking optical flats. Part of the works will be devoted to the production of Lapmaster 12-in. lapping machines.

The company is the agent in this country for the Swiss-made Diavite Microtester for the measurement of surface finish (see Machinery, 95/520—16/9/59), and can supply a monochromatic lamp unit for checking lapped components for flatness with the aid of an optical flat. Lapping of components on a contract basis is also carried out at works which have recently been established by the company at Huddersfield and East Kilbride.

Armstrong Whitworth Extension

To meet increasing demands from the steel industry for cast-steel rolls, Armstrong Whitworth (Metal Industries), Ltd., Close Works, Gateshead-upon-Tyne, 8, are providing additional production space and equipment at a total cost of £300,000. A new building, 270 ft. long by 70 ft. wide, has been erected, and extensions are being made to the foundry. The new building, which was erected by Wright, Anderson & Co., Ltd., Gateshead, is served by an overhead gantry crane (Cowans Sheldon & Co., Ltd.) with a 50-ton main hoist and a 7½-ton auxiliary hoist.

A number of heavy-duty machine tools has been installed, including a Richards vertical turn-

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ing and boring mill with a 6-ft. diameter table; a 120-h.p. Craven roll-turning lathe for workpieces up to 55 in. diameter by 25 ft. long; and another lathe, by the same company, which will accept rolls up to 64 in. diameter by 28 ft. long. This latter machine has a 150-h.p. driving motor and an independent unit for internal threading operations in the ends of rolls. Selsyn electrical equipment is employed for synchronizing this threading unit with the headstock spindle.

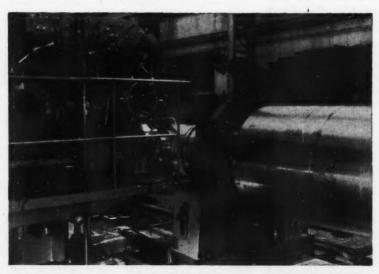
Another interesting addition to the equipment is a Craven horizontal milling machine, a close-up view of which is shown in the accompanying figure. A feature of this machine is that palmends of rolls can be machined on the side and end faces, and spade driving slots can be milled, at one set-up, an overhead attachment being employed for the latter operation. For milling the palm ends, an 18-in. diameter facing cutter is used, and the machine has a wide range of feed rates and spindle speeds.

It may be noted that the company is awaiting delivery of a large German-built roll grinding machine, which will accept work up to 40 in. diameter by 20 ft. long.

Standards for Hobs and Screw Gauges

BRITISH STANDARD FOR GEAR HOBS: PART 2: HOBS FOR GEARS FOR TURBINE REDUCTION AND

SIMILAR DRIVES (B.S. 2062: PART 2: 1960). Basic dimensions hobs required for the production of gears for turbine reduction and similar drives are now recommended for the first time in this revised specification. It has not been possible to achieve complete agreement on the dimensions, but recommended dimensions are given for the tooth forms and pitches listed in B.S. 1807: Part 2 (which relates to gears for turbines). dimensions are suitable for the larger hobbing machines used for this type of work. Recommended arbor dimensions are also included to ensure correct fit between hob and arbor.



Close-up view of a large Craven horizontal milling machine which is installed at the Close Works of Armstrong Whitworth (Metal Industries), Ltd., for operations on rolls for steel mills

As in the previous edition, accuracy requirements are laid down. The permissible errors given are similar to those in the previous edition but the layout of the table has been improved to make it comparable with that in Part 1 of the standard, a revision of which was published in 1959.

BRITISH STANDARD FOR SCREW GAUGE LIMITS AND TOLERANCES: PART 1: GAUGES FOR SCREW THREADS OF UNIFIED FORM (B.S. 919:1960). When the 1952 edition of B.S. 919 was prepared, it was not considered necessary to make any distinction between the tolerances for Unified thread gauges and those for, say, Whitworth form thread

ganges.

Experience has since shown, however, that some of the problems which arise in gauging Unified threads are different from those which may occur with other threads, and it has accordingly been thought desirable to separate the requirements for Unified gauges from those for other thread gauges. B.S. 919 is therefore being reissued in several parts, of which this—the first—deals only with gauges for Unified threads. In the preparation of the standard, every effort has been made to reconcile, as far as possible, differences between British and American practice in gauging Unified threads.

In addition to tolerances for types of gauges already in general use in this country, tolerances are also given for adjustable screw ring gauges and the associated setting plugs. The magnitude of these tolerances and of those for "go" and "not go" screw plug gauges is in accordance with the American Standard ASA Bl.2 (1952), except for the pitch tolerances of the gauges,

which are somewhat smaller.

The standard contains information on the functions of the various gauges and includes a section on the inspection of product threads. An appendix gives details of a recommended system of gauges

for coated screw threads.

Copies of these standards may be obtained from the British Standards Institution, Sales Branch, 2 Park Street, London, W.1. The price of B.S. 2062: Part 2: 1960, is 10s., and of B.S. 919: Part 1: 1960, 17s. 6d. Postage is charged extra to non-subscribers.

World Exports of Manufactures

The Board of Trade Journal for January 20 gave provisional figures of exports of manufactures by 11 leading countries in the period January to September, 1960. The United States heads the list with 8,458 million dollars, and the Federal Republic of Germany follows with 7,278 million dollars. The United Kingdom is third with 6,295 million

dollars, and is followed, in order, by France, Japan, and Italy. Figures are also given for percentage changes as compared with the corresponding period of the previous year, and it may be noted that the exports of Italy increased by 47.8, of France by 28.3, of Japan by 21, and of Sweden by 19.5 per cent. Of the countries listed, all showed increases, and the rise in the aggregate total was 18.3 per cent. The United Kingdom with 9.3 per cent had the smallest increase of any country listed.

Industrial Notes

G. Eltherington & Co., Ltd., Burdwell Works, Brockholes, near Huddersfield, inform us that they have received an order from overseas for 23 Ferracute transfer presses of 53 tons capacity, valued at nearly £30,000.

THE GAUGE AND TOOL MAKERS' ASSOCIATION, Standbrook House, 2-5 Old Bond Street, London, W.1. A party of 48 directors of member firms will visit Moscow while the British Trade Fair (May 19 to June 4) is in progress.

PHILIPS ELECTRICAL, LTD., Century House, Shaftesbury Avenue, London, W.C.2, are to take over for the office staff of Philips Electrical Industries, Ltd., five floors of the new 11-storey Berkshire House, which stands at the junction between High Holborn and Endell Street, only 50 yards from Century House.

The Export Credits Guarantee Department, 59-67 Gresham Street, London, E.C.2, report that export business insured under the "commercial" scheme in 1960 reached the record total of £694.5 million, which represented an increase of 8.8 per cent on the figure for 1959. This result was achieved despite the fact that for the last quarter of the year shipments declared for export were lower by £5 million than in the corresponding 1959 period.

VAUXHALL SUGGESTION AWARDS.—Six maximum awards of £450—the highest number in any year since the scheme was introduced in 1942—were paid to employees of Vauxhall Motors, Ltd., Luton, for cost-saving suggestions last year. A further 26 suggestions each earned an award of £100 or more. During 1960, the company paid out a total of £13,649 for 1,004 successful suggestions, out of 5,159 considered.

Lansing Bagnall, Ltd., Basingstoke, Hants., will show nine of their materials handling vehicles at the British Trade Fair to be held in Moscow in May. These exhibits will include a Rapide FOER5 electric fork truck which, it is stated, will operate on soft, uneven, ground, and in 10-ft. aisles; will travel at speeds up to 13 m.p.h.; and will lift loads up to 3,000 lb. Six of the vehicles, together with equipment, will be transported from the works to Moscow in one of the company's articulated lorries.

THE ELECTRICAL RESEARCH ASSOCIATION LABORATORY, Cleeve Road, Leatherhead, Surrey, recently published issue No. 12 of their house journal "Co-operative Electrical Research." It includes articles concerned with thermal deterioration of insulation; discharges in oil-paper insulation; the new E.R.A. committee structure; and test buildings for heating research. There are also notes on recent E.R.A. reports. Copies of the journal are obtainable from the Sales Department at the above address (price 2s. 6d. plus 6d. postage).

SWISSTOOL AGENCY ARRANGEMENTS.—In MACHINERY, 98/108—11/1/61, reference was made to agency arrangements for machines built or factored by Swisstool, Ltd., Zurich. In this connection we are asked to state that the agency agreement with Dowding & Doll, Ltd., 346 Kensington High Street, London, W.14, for sheet metal notching machines and Benninger universal thread milling machines, covers the whole of the United Kingdom, including Scotland.

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RUBERY OWEN & Co., Ltd., P.O. Box 10, Darlaston, Wednesbury, Staffs., are to discontinue the production of the Rubery Owen press brake guard, and this business is now being wound up. Guards at present on order will be completed and orders for a limited number of guards (twelve) for completion between now and the end of April next, will be accepted. The company will also continue to supply spares during the next twelve months, but from the end of April it will not be able to give maintenance service.

New Blast Furnace for Ford Motor Co., Ltd.,—Ashmore, Benson, Pease & Co., Ltd., Stockton-on-Tees, one of the companies in the Davy-Ashmore Group, have been awarded a contract by the Ford Motor Co., Ltd., Dagenham, to construct a new blast furnace with a hearth diameter of 20 ft. This furnace will be the 50th that Ashmore's have constructed in the United Kingdom and overseas during the past thirty years, and the order has come from the customer to whom the first was supplied. It is planned that the new furnace will go into production in the summer of 1962.

Courses on Ergonomics

The 6th course on ergonomics (the design of equipment for human use) organized by the Engineering Employers' West of England Association, Department of Work Study and Staff Training, Engineers' House, The Promenade, Clifton Down, Bristol, will be held from February 27 to March 10. It will be conducted by Mr. K. F. H. Murrell, M.A., a member of the Department of Psychology at Bristol University, and the number attending will be limited to 12, to permit thorough discussion and enable some practical work to be carried out. Full particulars can be obtained from the above address.

A further course will be held from November 20 to December 1.

Obituary

Mr. J. D. Coldwell, chief designer for Conveyancer Fork Trucks, Ltd., Liverpool Road, Warrington, died recently at the age of 56.

Correction

The address of Lanarkshire Bolt, Ltd., was inadvertently omitted from the advertisement for that company which appeared on page 144 of Machinery for January 25. The address is Hamilton, Lanarkshire, Scotland (telephone, Hamilton 1241/5).

MACHINERY'S ENQUIRY BUREAU

For many years Machinery has provided an enquiry service not only for subscribers and advertisers but for all engineers in need of such information as the names of makers—or their agents—of machines or equipment for performing particular operations, suppliers of various classes of material, firms with facilities for undertaking certain types of work, owners of trade names, and agents for foreign machine builders. If you have such a problem write (Machinery, Enquiry) Bureau, Clifton House, 83-117 Euston Road, London, N.W.1) or telephone (Euston 8441, 2 lines). This service is, of course, entirely free.

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MANUSCRIPTS FOR BOOKS covering all branches of engineering production will receive careful consideration and should be sent to the Manager, Book Dept., MACHINERY, National House, 21 West Street, Brighton, 1.

CONDITIONS OF SALE AND SUPPLY.—MACHINERY is sold subject to the following conditions

That it shall not, without the written consent of the publishers first given, be lent, resold, hired out or otherwise disposed of by way of trade except at the full retail price of 1s. 3d. and, that it shall not be lent, resold, hired out or otherwise disposed of in a mutilated condition or in an unauthorised cover by way of trade; or affixed to or as part of any publication or advertising literary or pictorial matter whatsoever.

Personal

Mr. A. Vincent, B.Sc. (Eng.), has been appointed export sales manager of Dowding & Doll, Ltd., 346 Kensington High Street, London, W.14. He was formerly export manager of Clarke-Built, Ltd.

MR. B. B. MANN has joined Electrical Remote Control Co., Ltd., Bush Fair, Harlow, Essex, and will be concerned with the company's technical advisory service on the application of process timing equipment in industry.

DR. A. E. W. Austen, B.Sc., Ph.D., A.M.I.E.E., F.Inst.P., has been appointed an executive director of C.A.V., Ltd., Acton, London, W.3. From 1946 he was chief research engineer for the company, and has held the position of chief engineer since 1959.

Mr. D. K. Fraser, joint managing director of G. A Harvey & Co. (London), Ltd., Greenwich Metal Works, London, S.E.7, has been appointed managing director. Mr. H. E. Cooper has relinquished his office of joint managing director but remains a director of the company.

Mr. A. S. Dick, chairman of the Standard Motor Co., Ltd., Coventry, has been awarded the Benjamin Franklin Medal for 1961 by the Royal Society of Arts. This award has been made "for his contribution to industrial progress in the motor car industry."

Mr. F. G. James, who was formerly general manager (manufacturing) of St. Regis Paper Co., Providence, Rhode Island, U.S.A., has joined The Cincinnati Shaper Co., Ltd., Peel Park Place, East Kilbride, Glasgow, as assistant managing director and works director.

MR. R. A. SWARBRICK has been transferred to the London office of Sanderson Brothers & Newbould, Ltd., Newhall Road, Sheffield, where he now holds the position of sales representative, in succession to Mr. D. B. Goodchild who has taken up an appointment with another company.

MR. D. E. BANHAM, A.M.I.Mech.E., A.M.I.Prod.E., has joined Precision Gear Machines & Tools, Ltd., Red Ring Works, Bodmin Road, Coventry, as works manager, and will take up this appointment on February 13. For the

past six years he has held the post of consultant with Associated Industrial Consultants, Ltd. Other new appointments which have been made by the company are as follows: Mr. TERENCE G. COOMBS, A.C.W.A., previously with the Crane Division of K & L Steelfounders & Engineers, Ltd., as management accountant; MR. JOHN G. H. SHIACH, chief engineer with the Marine Department of the British Transport Commission, as plant engineer; and Mr. John B. Hall, A.M.I.Mech.E., as production controller.



Mr. D. E. Banham

MR. HAYDN HOLLYMAN has been appointed area representative for the Midlands for Smith's Industrial Division, Kelvin House, Wembley Park Drive, Wembley, Middlesex. He replaces the late Mr. V. P. Scholes.

Mr. D. J. Rose has been appointed area sales manager in charge of the Birmingham branch of Richard W. Carr & Co., Ltd., Pluto Works, Wadsley Bridge, Sheffield, 6, Mr. J. Leavesley Buxton, sales director, and Mr. J. W. Borland, area sales manager, having left the company. Mr. C. Cartwright will continue to hold the position of heat treatment superintendent.

Coming Events

THE PLASTICS INSTITUTE.—Yorkshire Section. February 8, at 7.15 p.m., at St. Mark's House, 186 Woodside Lane, Leeds 2; lecture on "Machining and Finishing of Plastics," by a representative of Ekco Plastics Ltd.

Institution of Works Managers.—Leicester Branch. February 7, at 7.30 p.m., at the Grand Hotel, Leicester; "The Dilemma of Incentives," by R. L. Webster.

Institution of Production Engineers .- Wolverhampton Section. February 7, at 7.15 p.m., at Denbro, Ltd., Soho Hill, Handsworth, Birmingham, 19; lecture on "The Production of Form Tools," by D. W. Butchart. Ipswich and Colchester Section. February 10, at 7.30 p.m., in the Britannia Works Canteen, Davey Paxman Co., Ltd., Colchester; lecture on "Further Training of University Graduates with Particular Reference to Production Engineering," by S. H. Potter, B.Eng. Coventry Graduate Section. February 7, at 7.30 p.m., at Courtaulds Lecture Theatre, Lockhurst Lane, Coventry; lecture on "Automatic Equipment in the Metal Finishing Industry," by S. H. Grindrod. Dundee Section. February 8, at 7.30 p.m., at the Royal Hotel, Union Street, Dundee; lecture on "Small Quantity Flow Line Production," by E. Pennington. Section. February 10, at 7.30 p.m., at the Wheatstone Hall, Brunswick Road, Gloucester; lecture on "Materials Problems in Nuclear Energy," by Dr. P. Murray, B.Sc., Ph.D. Western Graduate Section. February 9, at 7.30 p.m., in the Small Lecture Theatre, Faculty of Engineering, Queen's Building, University of Bristol, University Walk, Bristol 8; lecture on "Research into Human Performances in Industry," by Dr. S. Griew, B.Sc., Ph.D.

Institution of Mechanical Engineers.—Industrial Administration and Engineering Production Group. February 8, at 6 p.m., at The Institution, 1 Birdcage Walk, Westminster, London, S.W.1; papers on "The Influence of Measuring Force, Stylus Radius and Surface Finish on the Accuracy of Measurement of Workpieces by a Comparator," by L. W. Nickols and T. R. J. Oakley, and "An Investigation into the Accuracy of Industrial Measurement of Sizes Between 0.02 and 5 in.," by P. W. Harrison.

INSTITUTION OF PLANT ENGINEERS.—A general meeting will be held on February 7, at 7 p.m., at the Royal Society of Arts, John Adam Street, London, W.C.2; paper on *Standards in Plant Engineering," by Dr. E. L. Diamond, M.Sc. (Eng.), Ph.D., divisional chief technical officer, British Standards Institution.

Machine Tool Share Market

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nd, er, Stock markets were fairly active during the period under review, but after being firm for the most part, they became unsettled, and most sections finished on a dull note.

British Government stocks were well supported, and attention was directed to other high-grade fixed interest stocks at improving levels, but final prices were below the best.

A satisfactory tone prevailed in the commercial and industrial share sections. There was some irregularity in price movements, but the trend, in the main, was to higher levels. Towards the close, however, an easier tendency developed

Among machine tool issues Edgar Allen advanced 6d. to 38s. 6d.; Birmingham Small Arms, 2s. 6d. to 43s.; British Oxygen, 1s. 6d. to 28s.; Chas. Churchill, 4½d. to 8s.; Coventry Gauge & Tool, 1s. 6d. to 25s. 6d.; Craven Bros. (Manchester), 3d. to 10s. 1½d.; B. Elliott, 6d. to 3s. 1½d.; John Harper, 1½d. to 8s. 3d.; Alfred Herbert, 3s. 9d. to 60s.; John Holroyd "B," 1s. 3d. to 15s.; Kerry's (Gt. Britain), 6d. to 10s.; Newall Engineering, 3d. to 6s. 6d.; Samuel Osborn, 3d. to 43s. 3d.; Stedall & Co., 3d. to 7s. 9d.; and Tap & Die Corporation, 3d. to 14s. 9d. On the other hand, Arnott & Harrison lost 3d. at 13s. 3d.; Asquith Machine Tool, 1s. 3d. to 10s. 3d.; Brooke Tool,

1½d. at 6s. 4½d.; Clarkson (Engineers), 1s. 3d. at 27s. 6d.; Greenwood & Batley, 6d. at 25s. 9d.; and Thos. W. Ward, 6d. to 65s. 6d.

'ABWOOD MACHINE TOOLS, LTD.—Interim dividend 5 per cent (same).

ASQUITH MACHINE TOOL CORPORATION, LTD.—Dividend of 5 per cent for the year ended September 30, last.

Instrumentation and Productivity

The Society of Instrument Technology and the Birmingham Productivity Association will hold a one-day conference at the Birmingham College of Technology, Gosta Green, Birmingham, on March 29. Intended for manufacturers operating on a small to medium scale, the purpose of the conference will be to draw attention to various aspects of instrumentation which will increase productivity profitably. Papers will be concerned with the possibilities of increasing output from a given labour force; maintaining consistent quality of product by controlled measurement; and reducing scrap during processing by in-line inspection, including non-destructive testing.

An instrument exhibition will be staged in conjunction with the conference.

Further particulars can be obtained from Mr. D. Smith, I.C.I., Ltd., Metals Division, Kynoch Works, Witton, Birmingham 6.

COMPANY		Denom.	Middle Price	COMPANY		Denom.	Middle Price
Abwood Machine Tools, Ltd	Ord	1/-	1/3	Herbert (Alfred), Ltd	Ord	£1	60/-
Allen (Edgar) & Co., Ltd	Ord	£İ	38 /-xd	Holroyd (John) & Co., Ltd	"A" Ord	5/-	16/3
their (Lugar) a con, Ltd.	5% Prf	El	14/6*		" B " Ord	5/-	15/-
Arnott & Harrison, Ltd	Ord	4/-	13/3	9) 9) 99 *********	B OIU	3/-	13/-
Asquith Machine Tool Corp., Ltd	Ord	5/-	10/3	Jones (A. A.) & Shipman, Ltd	Ord	5/-	31/3
	40/ Cum Duf	£I	18/9		7% Cum. Prf.	5/-	5/-
Birmingham Small Arms Co., Ltd	Ord	10/-+	43/-	89 H 99	1% Cum. Fri.	3/-	31-
	FO/ C	£		V	F10/ 0 - 4		
	5% Cum. "A" Prf.		14/6	Kearney & Trecker-C.V.A., Ltd	Cum, Prf.	£I	11/-
41 41 41 41	6% Cum.	£I	17/6	40 10 10 10	Prefd. Ord	£I	13/9
	6% Cum. B" Prf.			Kearns (H. W.) & Co., Ltd	Ord	5/-	17/6
,, ,, ,,		Stk.	904	Kerry's (Gt. Britain), Ltd	Ord	5/-	10/-
	Deb.	-		Macreadys Metal Co., Ltd	Ord		15/-
British Oxygen Co., Ltd	Ord	5/-	28/-	Martin Bros. (Machinery), Ltd	Ord		2/-
	6% Cum. Prf.	El	20/-	Massey (B. & S.), Ltd	Ord	5/-	10/-
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Brown (David) Corporation, Ltd	54% Cum. Prf.	£i	16/-	Newman Industries, Ltd	Cord.	2/-	
		61			6% Prf. Ord.	5/-	5/-1
Buck & Hickman, Ltd	6% Cum. Prf.		18/-	Noble & Lund, Ltd	Ord	2/-	4/-
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	5% Cum. Prf.	£I	14/3	Osborn (Samuel) & Co., Ltd	Ord	5/-	43/3
Churchill (Charles) & Co., Ltd		2/-	8/-	11 11 11		£I	25/-
99 99 99 100000000	6% Cum. Prf.	£I	25/91	Pratt (F.) & Co., Ltd	Ord	5/-	14/9
Churchill Machine Tool Co., Ltd	Ord	5/-	39/6	Sanderson Kayser, Ltd	Ord	10/-	34/4
	6% Cum. Prf.	£i	18/-		64% Cum. Prf.	13	18/-
Clarkson (Engrs.), Ltd	Ord	5/-	27 /6	Scottish Machine Tool Corporation	Ord	4/-	10/-
Cohen (George), 600 Group, Ltd	Ord	5/-	12/6	Ltd.		.,	
		-,	.=/-	Shardlow (Ambrose) & Co., Ltd	Ord	£I	45 /
	44% Cum. Prf.	£I	13/-	Shaw (John) & Sons, Wolverhamp-	Ord	5/-	16/3
Coventry Gauge & Tool Co., Ltd	Ord	10/-	25 6xd	ton. Ltd.	Old	3/-	10/3
		£1	16/3	Sheffield Twist Drill & Steel Co., Ltd.	0-4	4/-	15/6
20 20 10	Red. Prf.	LI	10/3	Snemela I wist Drill & Steel Co., Ltd.	Ord	13	
Craven Bros. (Manchester), Ltd		5/-	10/14	Stedali & Co., Ltd	5% Cum. Prf.	21	14/3
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				Sykes (W. E.), Ltd	" B " non-	10/-	24/-
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Greenwood & Batley, Ltd	Ord	10/-†	25/9	19 10		£I	14/6
farper (John) & Co., Ltd	Ord	5/-	8/3			61	
	410/ Pad	£i	10/3	13 13 *********************************	5% Cum.	2.1	23/-
19 19		13	12/3	SACH L. L. L.	2nd Pref.		
	Cum. Prf.			Willson Lathes, Ltd	Ord	1 1/-	3/4

The Middle Prices given in the list are in several cases nominal prices only and not actual dealing prices. Every effort is made to ensure accuracy, but no liability can be accepted for any error.

Sheffield price. † Ordinary £I shares have been subdivided and are now Ordinary 10-1 units. † Birmingham price.

PRICES OF MATERIALS

All prices per ton except where otherwise stated.

Bulcht Day

Pig Iron					MAKERS' PRICE	S
Foundry and Forge					Hexagon Steel Bars ¹	
No. 3, Class 2 Middlesbrough (10 tons or over Birmingham (10 tons or over)		17		0	Sizes in inches from 1 in. up to 2·21 and 2·41 a/f ex works, 2 ton basis Free cutting black	£42 17 (£47 6 6
Phos. Over 0.1 up to 0.4%					Reeled Steel Bars ¹	
Birmingham (6 ton lots) Grangemouth (6 ton lots)	(23 (23	10	-	0	Single-reeled, I in. upwards, f.o.t. works (+ usual extra for sizes)	643 9 6
Hæmatite English No. I (10 tons					Free cutting Precision-ground Mild St	£47 19 (
N.E. Coast (made in N.E.) Scotland	£23	5	-	6	I-in. diam. + 0.00025-in.	
Sheffield	£25	9	0	0	4-ton lots, per cwt.	121s. 6d.
Welsh 10 tons or over	€23			0	Bright Ground Stainless Steel Bars ²	
Steel Products					EN56AM (martensitic, free cuttin	(304 IO 0
Medium plates (50 tons andover Mild steel plates, ordinary (50 tons and over	r) £43			5	EN58AM (austenitic free cutting) Prices are basic, subject to extra	£377 10 0
(50 tons and over)	£42	17	6	3	High-speed Steel	
Boiler plates (50 tons and over) Flat bars, 5 in. wide and under (50 tons or over)		1	(,	Black random length bar. All p per lb., subject to extras:	
Round bars, under 3 in. (50 tons or over)	£39	1	()	Molybdenum " 66" Molybdenum " 46"	6s. 5d. 6s. 3d.
or over) Billets, rolling quality, soft U.T. (100 tons or over)	£31	15	6	5	14 per cent tungsten	6s. 11d.
					16 per cent tungsten	7s. 4d.
Phosphor Bronze					18 per cent tungsten	7s. 9d.
Ingots (288) (A.I.D. d/d	£304	0	(,	22 per cent tungsten 5 per cent cobast	9s. 2d.
Copper					4.75/5.25 molyhdanum	108. 100.
Cash (mean) Cold rolled and hot rolled sheet 4 ft. by 2 ft. by 10 SWG	£217	17		6	+ 6-0/6-75 tungsten + I-75/2-05 vanadium per cent (5-6-2)	6s. 7d.
	-297 £311	0	0		Precision-ground, High-sp	
Rods, & in. to & in. diam. Tubes, I in. bore by 10 SWG, ton lots, per lb.	3s.	0	id.		Free-turning Bras f-in. diam. ±0.00025-in., 2 ton lots, per lb.	
ton lots, per lb. Wire rod, black, hot-rolled (1-15 in.), English	£233	7	•	,	Gray Iron Rod	2s. 94d.
Zinc					Die Cast ⁴ in random lengths	18 in. to
Refired, minimum 98 per cent purity, current month (mean)	£79	ı	3		Die Cast ⁴ in random lengths 26 in. rough machined \(\frac{1}{2}\)-in. a size. Extra for definite leng counts for orders over £150.	that Dis-
Brass					Per cwt Mark I	. net. Mark III
Tubes, solid drawn, per lb. Strip 63/37, 6in. by 10 SWG coil ton lots £252 0 0—	1s. -£255	9	ld.		† or † in. 260s. 3d. i or i† in. 208s. 4d. i to i† in. 146s. 3d.	338s. 3d. 267s. 3d.
ton lots £252 0 0— Rods, }-3 in. diam. (59 per cer copper)	nt	113		- 1	† or ‡ in. 260s. 3d. 1 or 1 ‡ in. 200s. 4d. 1 to 1 ‡ in. 146s. 3d. 1 ‡ to 2 in. 12s. 7d. 2 ‡ to 3 ‡ in. 97s. 1d. 3 ‡ to 12 in. 91s. 9d.	181s. 7d. 133s. 6d. 112s. 9d. 105s. 3d.
Yellow Metal					Continuous Cast	
Condenser plates, per ton Rods, per ib.	£182 2s	. 0	ld.		10-ft. lengths, centreless machine diam. + 0.010 to 0.020 in., quoted for die cast bar4	d I to 3-in. prices as
Aluminium					centreless ground I or It in. 2 +0.010 in. Extra	202s. 3d.†
Ingots, min. 99-5 per cent Canadian d/d	£186	0	0	,	+0.010 in. Extra for hardenable alloy iron ⁵ Per cwt. net 1\frac{1}{2} \text{ to } 1\frac{1}{2} \text{ in.}	142s. 0d.†
Tinplates					Per cwt. net 2 to 3 in.	94s. 3d.†
#11 K Home trade:					† All prices+3 per cent Stellites	
Cold reduced, f.o.r. makers	£3	6	8		Welding Rods, plain	
Hot rolled basis, f.o.r.					in. diam., per lb.	30c. 0d.
Cold reduced basis for	d.—76	s. C	od.		Toolbits	
Cold reduced basis, f.o.r. works port 73s. 6	d.—76	s. (bC.		in. sq. x 4 in., each	22s. 3d.
Gunmetal					Street, London, W.I. 8 Pratt, Lev	rosvenor
Ingots, B.S. 1400 L.G.2, delivere	d £214	0	0	,	1 Colvilles, Ltd., Glasgow, and 17 Street, London, W.I. & Pratt, Lev. Ltd., Chester. & Spartan Steel & A St. Stephens Street, Birmingham, bridge Alloy Castings, Ltd., Sutfield. & Flocast, Harold Andro bridge, Ltd., Halesowen. & Delo Ltd., Highlands Read Shirles Soils	lloys, Ltd., 6. 4Sheep- ton-in-Ash-
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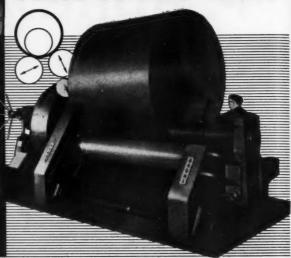
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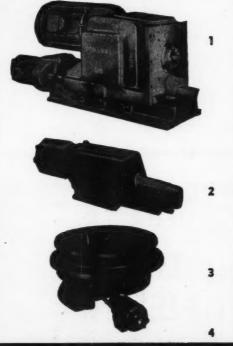
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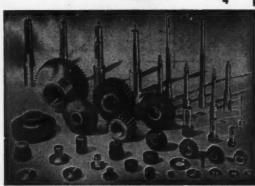
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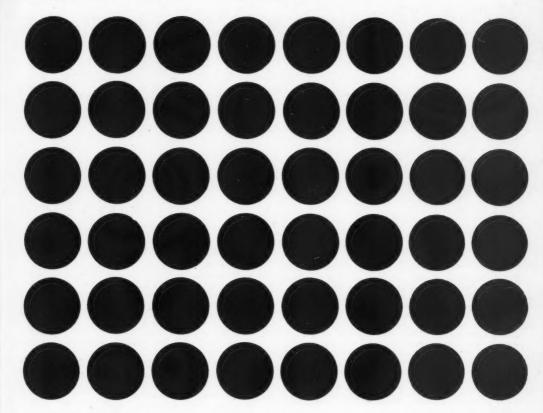
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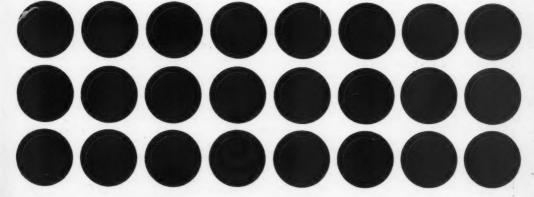
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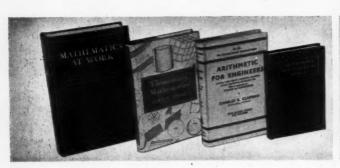
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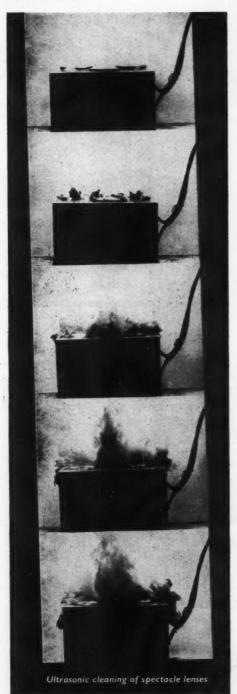




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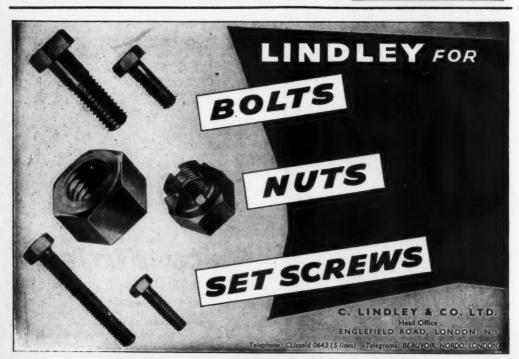
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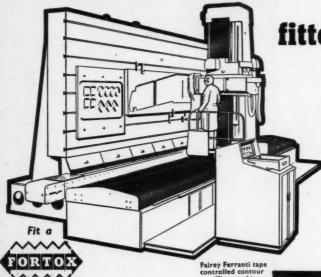


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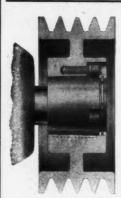
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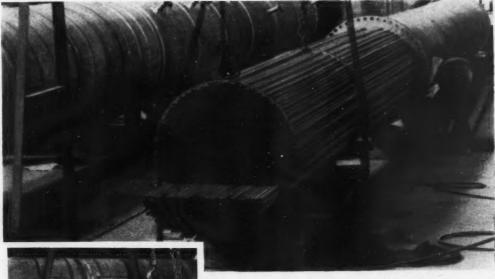
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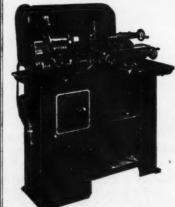
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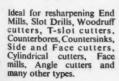
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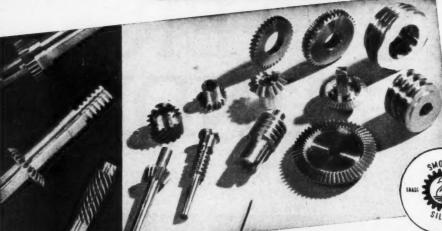
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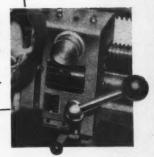
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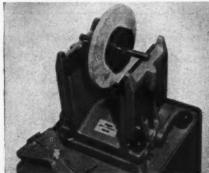




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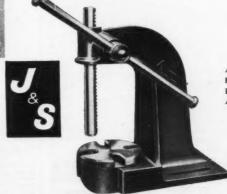


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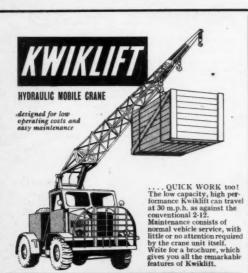
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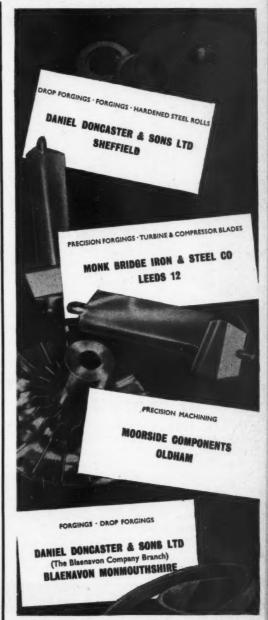
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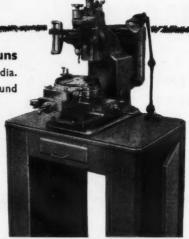
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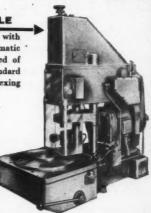
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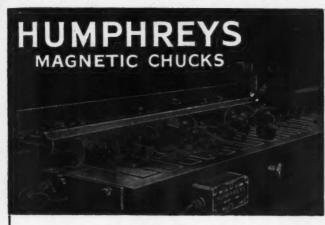
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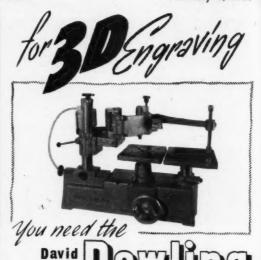
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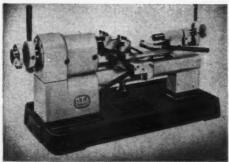


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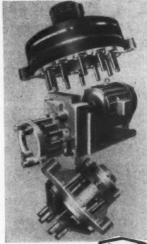
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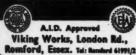
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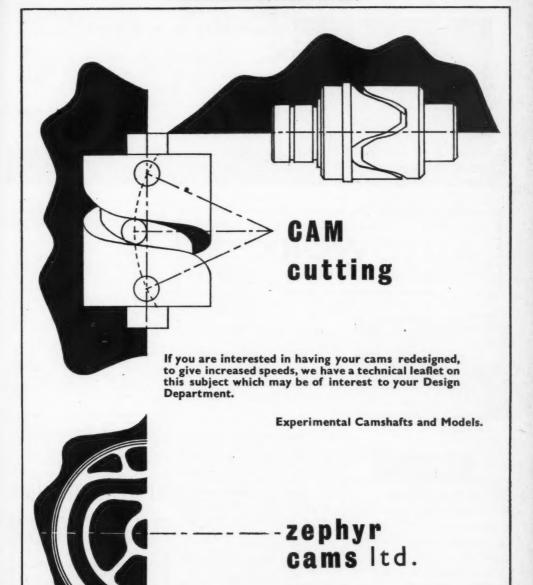
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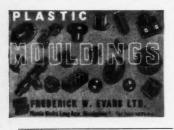
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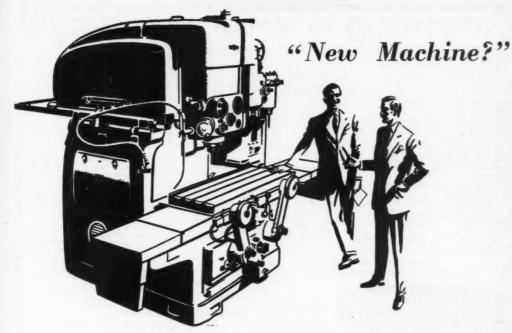
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                                               RIVETING MACHINES
   in. capacity.
                                            CENTRING MACHINES
  4in. capacity.

HORIZONTAL BORING MACHINES
2\(\frac{1}{2}\)in. Spindle.
       in. Spindle.

Centre Height: 3†in. Universal.
4-in. Universal.
5-in. Universal.
7-in. Universal.
9-in. Universal.
                                      CIRCULAR MILLING TABLES .
       Diameter: 11‡in. Hand Operated.
15‡in. Hand Operated.
15‡in. Motorised.
19‡in. Hand Operated.
  194in. Hand Operated.
SHEET METAL WORKING MACHINERY
PRESSES
3-Ton Bench, Fixed Stroke, 180 s.p.m.
4-Ton Adjustable Stroke, 180 s.p.m.
4-Ton Floor, Adjustable Stroke, 140 s.p.m.
4-Ton (Deep Throat) Adjustable Stroke, 140 s.p.m.
5-Ton Bench, Adjustable Stroke, 180 s.p.m.
20-Ton Ungeared Adjustable Stroke,
30-Ton Ungeared Adjustable Stroke.
   UNIVERSAL POWER PUNCHING AND SHEARING
   in. Plate Shearing.
                                                     BENDING ROLLS
  80in. by £in. Power.
40in. by 16g. Hand.
40in. by £in. Hand.
                                             HAND LEVER SHEARS
  Various.
                                                         ROD CUTTER
 Various.

CURVE CUTTING PLATE SHEARS

4in. Blade by $\frac{1}{3}$ Sheet.

5\frac{1}{2}in. Blade by $\frac{1}{3}$ Sheet.

CIRCLE CUTTING MACHINES

3\frac{1}{2}in. by 40in. by $\frac{1}{2}in. Power.

UNIVERSAL FOLDING MACHINES
 80in. by 14g. Hand.
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bore 3 in. M.D. 400/3/50. HUNT Model IA Twist Drill Grinder. Cap.

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BULLARD 8in. Mult-au-Matic, 6 spindles,

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Hydraulic chuck and tallatock. Front profiling slide, rear facing slide, 15 h.p., two-speed motor. Post-war machine. Excellent condition.—LEE & HUNT, LYD., Crocus Street, Nottingham. Tel.: 84246.

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ARCHDALE 30in. Vertical Milling Machine.
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S.C.M.D. 400-440/3/50.
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Hydraulic Vertical Internal Honine Machine
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Keen Frentice No. 6 Large Vertical Milling Machine. Table 84in. × 20in. 34in. tee slots. Table traverse long. 72in. Table traverse trans 24in. Power feeds and rapid feeds, spindle speeds 15 to 500 r.p.m. Spindle traverse 12in., head traverse 24in. Throat. clearance 28in., daylight max. 38in., min. 2in. Seen London area.—BOX C558, MACKINEBRY, Clifton House, Euston Road, N.W.1.

1,000 Ton 'Eumuco' Knuckle Joint Coining and Sizing Press, steel plate construction, 2in. stroke, 31in. between sides with 40 h.p. motor drive.

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Kearns No. 2 Horiz. Boring and Facing Machine, travelling spindle 2 Hin. dia., facing head 20in. dia., will face up to 30in. dia., main tee slotted table 48in. × 30in., top tee slotted table 36in. × 36in., max. distance facing head to outer support 72in. 12 speeds to spindle, 8 feeds to facing head, both top speeds approx. 200 r.p.m., 8 feeds from 8-96 c.p.l., main drive through we belt from 10 h.p., 400-440) 3/50 motor, complete with Star Delta Starter

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LATHES NOBLE & LUND Heavy Duty Centre Lathe, . 22in. centre height × 29ft. between centres. Max. swing over saddle 33in. dia.

BILLETER Hydraulic Open-side Slideway Grinding Machine, capacity 47in. × 12in

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AUTOMATICS

GREENLEE Ifin. capacity 6-spindle Bar Automatic. INDEX Model ON.8 15 in. capacity single spindle Bar Automatic-

BORERS

NEWALL No. I Jig Borer, toolroom condition.

PEARN RICHARDS No. 3 Horizontal Borer, main table 7ft, 3in-by 5ft., top table 6ft. by 6ft. Fitted 24in. diameter facing head 36in. capacity. Serial No. 9328. RICHARDS No. 2 Horizontal Borer, with traversing spindle, facing head. Main table 4ft. 0in. by 2ft. 6in., revolving table 3ft. 0in. by 3ft. 0in. Rebuilt.

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WARD 10B Comb. Turret Lathe, hole in spindle 4in. dia. Speeds

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WARD 3A Capstan Lathe, with hand operated collet chuck, built 1948.

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GLEASON 12in. Comb. Bevel Gear Generator, double roll type Serial No. 20224. GLEASON No. 24 straight Bevel Gear Generator, Serial No. 17920. FELLOWS No. 70 Gear Shaper.

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SHANKS 42in, by 240in, speeds 0-8 to 37-2 r.p.m. 10ft. 0in. dia face plate. Swing in gap 138in. UNUSED, SWIFT 13in. by 132in. B.C. speeds 3-6 to 220 r.p.m. Rapid traverse

to saddle.

WARD HAGGAS & SMITH 12\(\frac{1}{2}\)in. by 180in. B.C. Gap bed, speeds
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MONARCH 12in. by 48in. Type 24M Straight Bed, speeds 9 to

SPRINGFIELD 12in. by 48in. B.C. Straight Bed, speeds 9 to 280 r.p.m. with taper turning, chuck, steady. UNUSED. PROGRESSIVE I lin. by I 20in. B.C. Gap Bed, speeds 20 to 516 r.p.m.

JOHN MITCHELL 84in. by 4ft. 6in. B.C. Gap Bed, spindle 24in. speeds 30 to 600 r.p.m. NEW.

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BRADFORD 8in. by 30in. B.C. Straight Bed. Speeds 16 to 400 r.p.m.

WILLSON Mk. V 7½in. by 4ft. 0in. B.C. Gap bed. NEW. GRANOR 7½in. by 84in. B.C. Gap Bed. speeds 6 to 300 r.p.m.

CHURCHILL REDMAN 14in. by 20in. Hydraulic Profile Copying Lathe, built 1957. AS NEW.

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VAN NORMAN No. 3 table 64in. by 14in. speeds 25/1,250 r.p.m. MILWAUKEE 3H table 64in. by 131in., speeds 20 to 1,000 r.p.m.

ARCHDALE 20in., table 40in. by 12in., speeds 60 to 1,230 r.p.m.; with separate motor for rapid longitudinal feeds, also vertical attachment. NEARLY NEW.

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EDGWICK No. 2, table 46in. by 11in., speeds 25 to 405 r.p.m. With vertical head.

BIERNATSKI No. I, table 40in. by Ilin., speeds 40 to 400 r.p.m. VICTORIA UI Table 40in. by 11in. Speeds 31 to 1,010 r.p.m.

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CINCINNATI No. 3 dial type, table 62½in. by 15½in., speeds 18 to 450 r.p.m. With power down feed.

CINCINNATI No. 2 dial type, table 52in. by 121in., speeds 20 to Choice of two

MILWAUKEE IH/18, table 39in. by 121in., speeds 35 to 1,400 r.p.m. With swivel head.

ADCOCK & SHIPLEY, table 37½in. by 10in., speeds 50 to 1,500 r.p.m. With sliding head.

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New HEINEMANN 20in., 24in., 28in., and 34in. Heavy Duty HIGH SPEED SHAPERS, also with copying units. BROOK 18in. stroke Shaping Machine.

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BROACHING AMERICAN Model H2, stroke 30in.

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LIENHARD 3 Dimensional.
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SAFAG Pinion
MAXICUT 7in. × 2in. × 6 D.P.
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HEALD 25in. Ring.
CHURCHILL OSB 8in. × 30in.
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LUMSDEN Vert. 210 XXM.
SNOW Table 20in.
ABRASIVE No. 34 Vertical Spindle.
ABRASIVE No. 14 in. × 8in.
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GRINDERS (Cylindrical) NEWALL 10 × 24 hyd. COVENTRY GAUGE 6in. × 12in. CHURCHILL 7 × 36in. CHURCHILL PBH 12 × 36in. Uni. NEWALL 6 × 18. FRANCIS 6 × 7. PRECIMAX MPB 10 × 48.

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STEDALL WUNDERLI Carbide,
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COULTHURST Surfacing and Boring.
RYDERMATIC No. 12 Multi Tool.

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ROSCHER EICHLER, Table 39in. × 12in.

SUNDSTRAND No. 0 Production.

PALLAS LIM, Table 30in. × 7in.

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ADCOCK & SHIPLEY Model OCD.

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GERMAN Rotary Punch.
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SCHULER VZZ, 15 tons d/s gripper feed. PROFILING MACHINE
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HIGH SPEED Hammer, 7/16 cap. TURNER RH 18 (§in.) RH38 (§in.) and RH34 (‡in.). TURNER RH 14/12 (‡in.) RS6 (‡in.).

SCREWING MACHINE ATLAS No. 2, 3in.-6in. (Unused.) SHAPERS INVICTA 24in. NEWEY 14in.

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ESSEX No. 124, in. cap and No. 24.
THIEL No. 4, i-9/32nds.
ACE Horiz., in. capacity.
HASKINS Type 3 C.A.M., in. cap. J & S Electrotap, in.

THREAD MILLERS
JONES FBI 4ft. between centres.

Willson 8-in. Lathe, 6ft. 0in.
between Centres, new 1953. Complete
Equipment, Motor, etc.
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PAISLEY

Lang Heavy Duty Boring and
Facing Lathe, 14in, swing × 54in, between
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432 c.p.i. Hole in spindle 18in, dia, £200 ex
works O.N.O. London area.—BOX C575,
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Worthington Simpson 2-stage
Air Compressor. Air cooled, size 100.
Brooks Motor 21-h.p. 4004-40/3/50. Syn. speed
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No. 16 Herbert Vertical Milling Machine. Table 55in. × 13 in. Long. traverse 34in. 16 speeds 16-427 r.p.m. S.C.

Traverse Sein. In species Loves 1, p. 11.

No. 2 Equivel: Vertical Milling Machine, with power operated rotary table. Table 46 in. × power operated rotary table 18 in.

Coulthurst 91in. All Geared Head Surfacing and Boring Lathe. 400/3/50.— HICKS MACHINERY, LTD., 26, Addison Place, London, W.11. Tel.; PARk 2333.

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GRANOR OF HALIFAX 28in, stroke Heavy Duty Shaping Machine. 400-440/8/50.

EARLY DELIVERY

MITCHELL OF KEIGHLEY 84in. Type DMS Gap Bed Lathe, by 5ft. 3in. B.C. 400-440/350. January, 1961 delivery. MITCHELL OF KEIGHLEY 104in. Type DM10 Gap Bed Lathe by 5ft. 5in. between centres. 400-440/350. December deli-

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ETYCHELL OF KEIGHLEY 12in. Type

DM12 Gap Bed Lathe by 6ft. 9in. B.C.

400-440/s/50. April delivery.

VIOTORIA No. 2 Rapidmil Universal Milling

Machine, table size 48in. × 11in.

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Table size 45in. × 11in.

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CENTAUR TOOL WORKS, EYRE STREET, SPRING HILL, BIRMINGHAM, IS

el.: EDGbaston 1118 & 1119 'Grams: Capstan, Birmingh VICTORIA U.3 Universal Milling Machine, 415/3/50, table W.S. 60in. × 124in. With Dividing Heads and Vertical Milling

THREE—28in. ARCHDALE Plain Horizontal Milling Machines, 415/3/50. Table W.S. 49in. × 10in.



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Telephone: ELGar 4841/4842

Ormerod 16in. Double Headed Ormerod 16in. Double Headed
Heavy Duty High Speed Shaper, length of
stroke 16in., length of bed 10ft. 0in., width of
bed 1ft. 9in., depth of bed 2ft. 10in., feed of
toolbox 6in., max. section of tools in toolholder
14in. × 14in., traverse of each headstock
5ft. 0in., 12 feeds to headstock 0.01in. to 120in.,
max. distance between tools 6ft. 6in., min.
1ft. 6in., two tables supplied, 9 speeds to ram,
ram strokes per min. 11 to 120, 1952 machine,
almost new condition.

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Pels Universal Punching, Shearing and Cropping Machine, Model MK 16,
will punch 1 ½ in. dia. through in. material, or
in. dia. through in. material, will shear 1 in.
dia. rounds and 1 in. square, angles 6 in. × 4 in.
× ½ in., or 8 in. × 3 in. × ½ in. ces 8 in. ×
5 in. × 3 in. motorised 400-440/3/50 through
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Loewe Boring and Facing Lathe, high speed machine, 475 to 3,000 r.p.m. Swing 16in. Multi-speed motor, 400/3/50.— BOX C 606. Machineby, Clifton House, Euston Road, N.W.1.

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CRAIG & DONALD Deep Gap Guillotine Shearing Machine. Motorised for 400/3/50 supply. With automatic hold-down and adjustable back gauge. Capacity 14th. × in. Complete with three spare set of blades. Weight approx. 11 tons.

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centres.
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Head swivel all directions. Hand feed to
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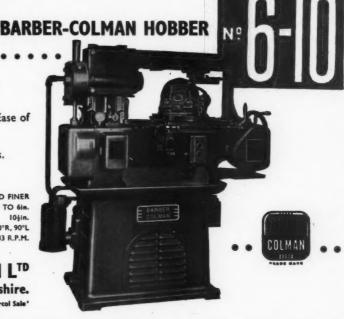
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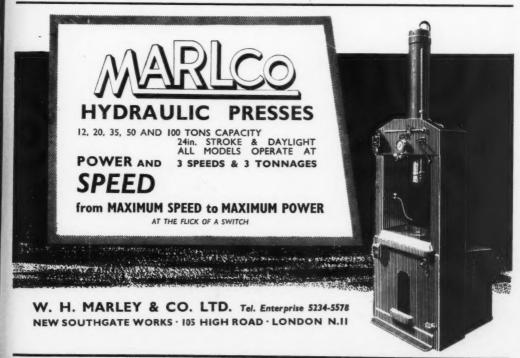
CAPACITY:

SPUR AND HELICAL 12 DP AND FINER
BLANK DIAMETER UP TO 6in.
MAX. TRAVEL OF HOB SLIDE
MAX. SWIVEL ANGLE SETTING
HOB SPEEDS (STANDARD) 133/533 R.P.M.

BARBER & COLMAN L^{TD} BROOKLANDS, Sale, Cheshire.

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This is a new cabinet type machine which Dawsons supply to wash all sizes and types of crankshafts. A pneumatically operated carrier lowers the crankshafts into the cleaning position where special jets in the form of upper and lower bearing caps having annular grooves in the internal diameter locate closely on the journals allowing the alkaline solution to be forced through the oilways in the journals and out through the crank pins. At the same time jet pipes above and below thoroughly wash the external surfaces of the shafts.

The machine illustrated handles up to 20 crankshafts per hour, and is also available as an "In-line" machine loading at one end and discharging at the other. "In-line" machines are available to handle up to 120 crankshafts per hour.

PATENTS



Manufacturers: DAWSON Bros. Ltd., Gomersal, Near Leeds London Works: 406 Roding Lane South, Woodford Green, Essex

Tel: Cleckheaton 3422 (7 lines)

Tel: Crescent 7777 (4 lines)

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